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PART 22 MEASUREMENT REPORT

Applicant Name:
Samsung Electronics Co., Ltd.
129, Samsung-ro,
Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

Date of Testing:
9/19 - 11/16/2021
Test Report Issue Date:
12/02/2021
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M2109090102-02-R1.A3L

FCC ID:	**A3LSMS908U**
Applicant Name:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	SM-S908U
Additional Model(s):	SM-S908U1
EUT Type:	Portable Handset
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part:	22
Test Procedure(s):	ANSI C63.26-2015, ANSI/TIA-603-E-2016, KDB 971168 D01 v03r01, KDB 648474 D03 v01r04

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

Note: This revised Test Report (S/N: 1M2109090102-02-R1.A3L) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Randy Ortanez
President

ACCREDITED
CERT #2041.01

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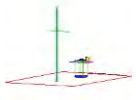


Mode	Bandwidth	Modulation	Tx Frequency Range [MHz]	ERP		EIRP		Emission Designator
				Max. Power [W]	Max. Power [dBm]	Max. Power [W]	Max. Power [dBm]	
LTE Band 26/5	15MHz (Band 26 only)	QPSK	831.5 - 841.5	0.059	17.69	0.096	19.84	13M5G7D
		16QAM	831.5 - 841.5	0.046	16.62	0.075	18.77	13M6W7D
	10 MHz	QPSK	829.0 - 844.0	0.060	17.80	0.099	19.95	9M02G7D
		16QAM	829.0 - 844.0	0.050	16.98	0.082	19.13	9M04W7D
	5 MHz	QPSK	826.5 - 846.5	0.060	17.78	0.098	19.93	4M55G7D
		16QAM	826.5 - 846.5	0.048	16.80	0.079	18.95	4M54W7D
	3 MHz	QPSK	825.5 - 847.5	0.061	17.85	0.100	20.00	2M72G7D
		16QAM	825.5 - 847.5	0.051	17.06	0.083	19.21	2M72W7D
	1.4 MHz	QPSK	824.7 - 848.3	0.060	17.75	0.098	19.90	1M11G7D
		16QAM	824.7 - 848.3	0.049	16.87	0.080	19.02	1M11W7D
NR Band n5	20 MHz	π/2 BPSK	834.0 - 839.0	0.089	19.49	0.146	21.64	18M0G7D
		QPSK	834.0 - 839.0	0.089	19.49	0.146	21.64	19M0G7D
		16QAM	834.0 - 839.0	0.071	18.53	0.117	20.68	19M0W7D
	15 MHz	π/2 BPSK	831.5 - 841.5	0.089	19.51	0.147	21.66	13M5G7D
		QPSK	831.5 - 841.5	0.090	19.56	0.148	21.71	14M2G7D
		16QAM	831.5 - 841.5	0.068	18.34	0.112	20.49	14M3W7D
	10 MHz	π/2 BPSK	829.0 - 844.0	0.085	19.31	0.140	21.46	9M02G7D
		QPSK	829.0 - 844.0	0.084	19.25	0.138	21.40	9M37G7D
		16QAM	829.0 - 844.0	0.064	18.06	0.105	20.21	9M39W7D
	5 MHz	π/2 BPSK	826.5 - 846.5	0.083	19.17	0.136	21.32	4M52G7D
		QPSK	826.5 - 846.5	0.087	19.38	0.142	21.53	4M56G7D
		16QAM	826.5 - 846.5	0.066	18.20	0.108	20.35	4M54W7D

Mode	Modulation	Tx Frequency Range [MHz]	ERP		EIRP		Emission Designator
			Max. Power [W]	Max. Power [dBm]	Max. Power [W]	Max. Power [dBm]	
GSM/GPRS	GMSK	824.2 - 848.8	0.318	25.02	0.521	27.17	249KGXW
EDGE	8-PSK	824.2 - 848.8	0.100	19.99	0.164	22.14	246KG7W
WCDMA	Spread Spectrum	826.4 - 846.6	0.059	17.73	0.097	19.88	4M16F9W

1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2 PCTEST Test Location

These measurement tests were conducted at the PCTEST facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

1.3 Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.

- PCTEST is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).

- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISED.

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID:A3LSMS908U**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate under the provisions of Part 22.

Test Device Serial No.: 0502M, 0424M, 0341M, 0452M, 1176M, 1158M, 1128M, 0432M, 0584M, 2246M

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 5G NR (FR1 and FR2), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII (5 and 6GHz), Bluetooth (1x, EDR, LE), NFC, UWB, Wireless Power Transfer

This device uses a tuner circuit that dynamically updates the antenna impedance parameters to optimize antenna performance for certain bands and modes of operation. The tuner for this device was set to simulate a "free space" condition where the transmit antenna is matched to the medium into which it is transmitting and, thus, the power is at its maximum level.

2.3 Test Configuration

The EUT was tested per the guidance of ANSI/TIA-603-E-2016 and KDB 971168 D01 v03r01. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

This device supports wireless charging capability and, thus, is subject to the test requirements of KDB 648474 D03 v01r04. Additional radiated spurious emission measurements were performed with the EUT lying flat on an authorized wireless charging pad (WCP) Model: EP-N5100 while operating under normal conditions in a simulated call or data transmission configuration. The worst case radiated emissions data is shown in this report.

2.4 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

2.5 Software and Firmware

The test was conducted with software/firmware version S908USQU0AUJK installed on the EUT.

3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the "Land Mobile FM or PM – Communications Equipment – Measurements and Performance Standards" (ANSI/TIA-603-E-2016) and "Measurement Guidance for Certification of Licensed Digital Transmitters" (KDB 971168 D01 v03r01) were used in the measurement of the EUT.

Deviation from Measurement Procedure……..None

3.2 Radiated Power and Radiated Spurious Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable 3 meters from the receive antenna. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

For radiated power measurements, substitution method is used per the guidance of ANSI/TIA-603-E-2016. A half-wave dipole is substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT. The power of the emission is calculated using the following formula:

$$P_{d\ [dBm]} = P_{g\ [dBm]} - \text{cable loss}_{\ [dB]} + \text{antenna gain}_{\ [dBd/dBi]};$$

where P_d is the dipole equivalent power, P_g is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to $P_{g\ [dBm]}$ – cable loss $_{[dB]}$.

For radiated spurious emissions measurements and calculations, conversion method is used per the formulas in KDB 971168 Section 5.8.4. Field Strength (EIRP) is calculated using the following formulas:

$$E_{[dB\mu V/m]} = \text{Measured amplitude level}_{[dBm]} + 107 + \text{Cable Loss}_{[dB]} + \text{Antenna Factor}_{[dB/m]}$$

And

$$EIRP_{[dBm]} = E_{[dB\mu V/m]} + 20\log D - 104.8;\ \text{where D is the measurement distance in meters.}$$

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014. Additionally, radiated emissions below 30MHz are also validated on an Open Area Test Site to assert correlation with the chamber measurements per the requirements of KDB 414788 D01.

Radiated power and radiated spurious emission levels are investigated with the receive antenna horizontally and vertically polarized per ANSI/TIA-603-E-2016.

4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.13
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	AP2	EMC Cable and Switch System	3/4/2021	Annual	3/4/2022	AP2
-	AP1	EMC Cable and Switch System	3/9/2021	Annual	3/9/2022	AP1
-	ETS	EMC Cable and Switch System	3/4/2021	Annual	3/4/2022	ETS
-	LTx2	Licensed Transmitter Cable Set	3/12/2021	Annual	3/12/2022	LTx2
-	LTx5	LIcensed Transmitter Cable Set	3/3/2021	Annual	3/3/2022	LTx5
Agilent	E5515C	Wireless Communications Test Set	N/A			GB45360985
Agilent	N9030A	50GHz PXA Signal Analyzer	1/20/2021	Annual	1/20/2022	US51350301
Anritsu	MT8820C	Radio Communication Analyzer	N/A			6201300731
Anritsu	MT8821C	Radio Communication Analyzer	N/A			6201381794
Com-Power	AL-130R	Active Loop Antenna	10/29/2020	Biennial	10/29/2022	10160045
Emco	3115	Horn Antenna (1-18GHz)	6/18/2020	Biennial	6/18/2022	9704-5182
Emco	3116	Horn Antenna (18 - 40GHz)	7/20/2021	Biennial	7/20/2023	9203-2178
ETS Lindgren	3164-08	Quad Ridge Horn Antenna	3/12/2020	Biennial	3/12/2022	128337
ETS Lindgren	3816/2NM	LISN	7/9/2020	Biennial	7/9/2022	00114451
Keysight Technologies	N9030A	3Hz-44GHz PXA Signal Analyzer	7/21/2021	Annual	7/21/2022	MY49430494
Agilent	N9030A	50GHz PXA Signal Analyzer	1/20/2021	Annual	1/20/2022	US51350301
Keysight Technologies	N9038A	MXE EMI Receiver	8/11/2020	Annual	12/11/2021	MY51210133
Mini-Circuits	SSG-4000HP	Synthesized Signal Generator	N/A			11208010032
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			100976
Rohde & Schwarz	CMW500	Radio Communication Tester	N/A			112347
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	8/3/2021	Annual	8/3/2022	100342
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	5/25/2021	Annual	5/25/2022	100348
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	8/25/2021	Annual	8/25/2022	103200
Sunol	JB6	LB6 Antenna	11/13/2020	Biennial	11/13/2022	A082816

Table 5-1. Test Equipment

Notes:

Equipment with a calibration date of "N/A" shown in this list was not used to make direct calibrated measurements.

6.0 SAMPLE CALCULATIONS

GSM Emission Designator

Emission Designator = 250KGXW
GSM BW = 250 kHz
G = Phase Modulation
X = Cases not otherwise covered
W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 250KG7W
EDGE BW = 250 kHz
G = Phase Modulation
7 = Quantized/Digital Info
W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M16F9W
WCDMA BW = 4.16 MHz
F = Frequency Modulation
9 = Composite Digital Info
W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 8M62G7D
LTE BW = 8.62 MHz
G = Phase Modulation
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

QAM Modulation

Emission Designator = 8M45W7D
LTE BW = 8.45 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

Spurious Radiated Emission

Example: Spurious emission at 3700.40 MHz

The receive spectrum analyzer reading at 3 meters with the EUT on the turntable was –81.0 dBm. The gain of the substituted antenna is 8.1 dBi. The signal generator connected to the substituted antenna terminals is adjusted to produce a reading of –81.0 dBm on the spectrum analyzer. The loss of the cable between the signal generator and the terminals of the substituted antenna is 2.0 dB at 3700.40 MHz. So 6.1 dB is added to the signal generator reading of –30.9 dBm yielding –24.80 dBm. The fundamental EIRP was 25.50 dBm so this harmonic was 25.50 dBm – (-24.80) = 50.3 dBc.

7.0 TEST RESULTS

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.

FCC ID: A3LSMS908U

FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)

Mode(s): GSM/GPRS/EDGE/WCDMA/NR/LTE

Test Condition	Test Description	FCC Part Section(s)	RSS Section(s)	Test Limit	Test Result	Reference
CONDUCTED	Transmitter Conducted Output Power	2.1046	RSS-132(5.4)	N/A	PASS	See RF Exposure Report
	Occupied Bandwidth	2.1049	RSS-Gen(6.7)	N/A	PASS	Section 7.2
	Conducted Band Edge / Spurious Emissions	2.1051, 22.917(a)	RSS-132(5.5)	> 43 + 10log10(P[Watts]) at Band Edge and for all out-of-band emissions	PASS	Sections 7.3, 7.4
	Frequency Stability	2.1055, 22.355	RSS-132(5.3)	Fundamental emissions stay within authorized frequency block	PASS	Section 7.8
RADIATED	Effective Radiated Power / Equivalent Isotropic Radiated Power	22.913(a)(5)	RSS-132(5.4)	< 7 Watts max. ERP	PASS	Section 7.6
	Radiated Spurious Emissions	2.1053, 22.917(a)	RSS-132(5.5)	> 43 + 10 log10 (P[Watts]) for all out-of-band emissions	PASS	Section 7.7

Table 7-1. Summary of Test Results

Notes:

1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables, directional couplers, and attenuators used as part of the system to maintain a link between the call box and the EUT at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables, attenuators, and couplers.
4) All conducted emissions measurements are performed with automated test software to capture the corresponding plots necessary to show compliance. The measurement software utilized is PCTEST EMC Software Tool v1.0.

7.2 Occupied Bandwidth

Test Overview

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 4.2

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

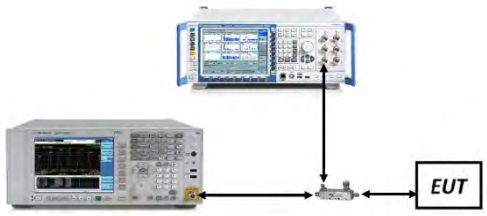
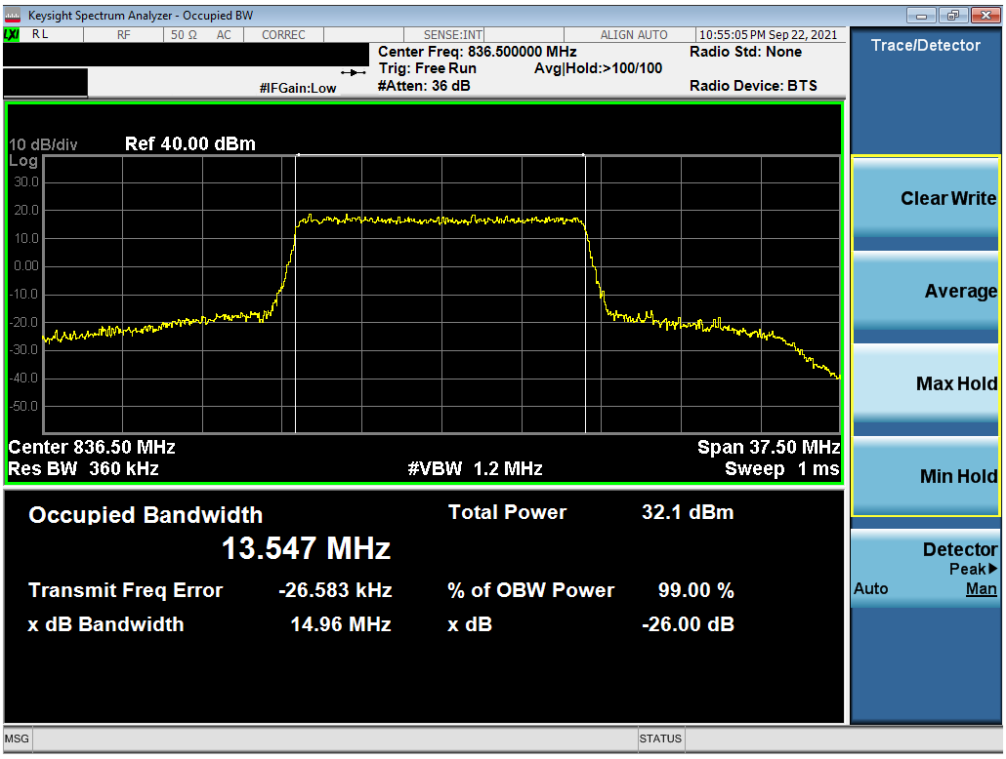


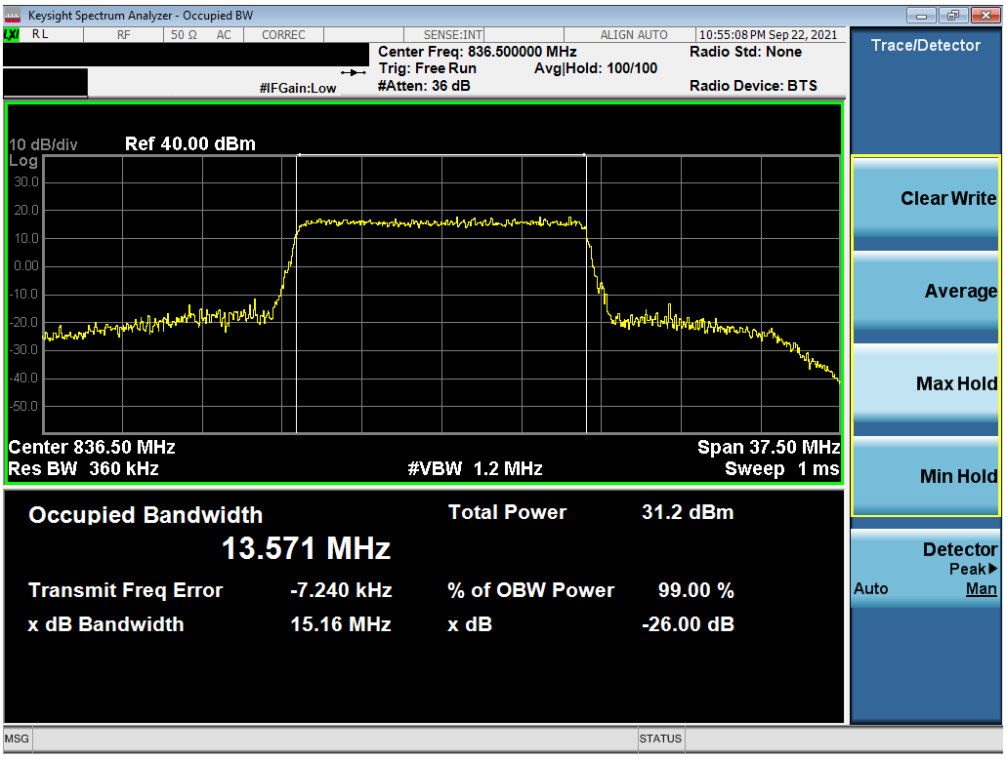
Figure 7-1. Test Instrument & Measurement Setup

Test Notes

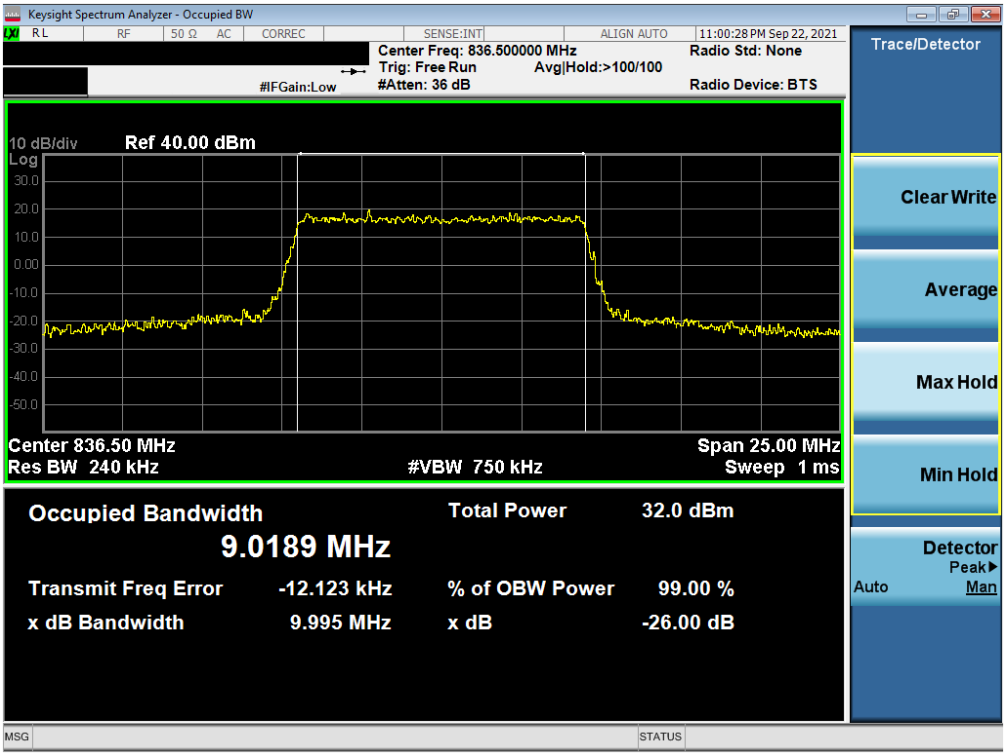
None.



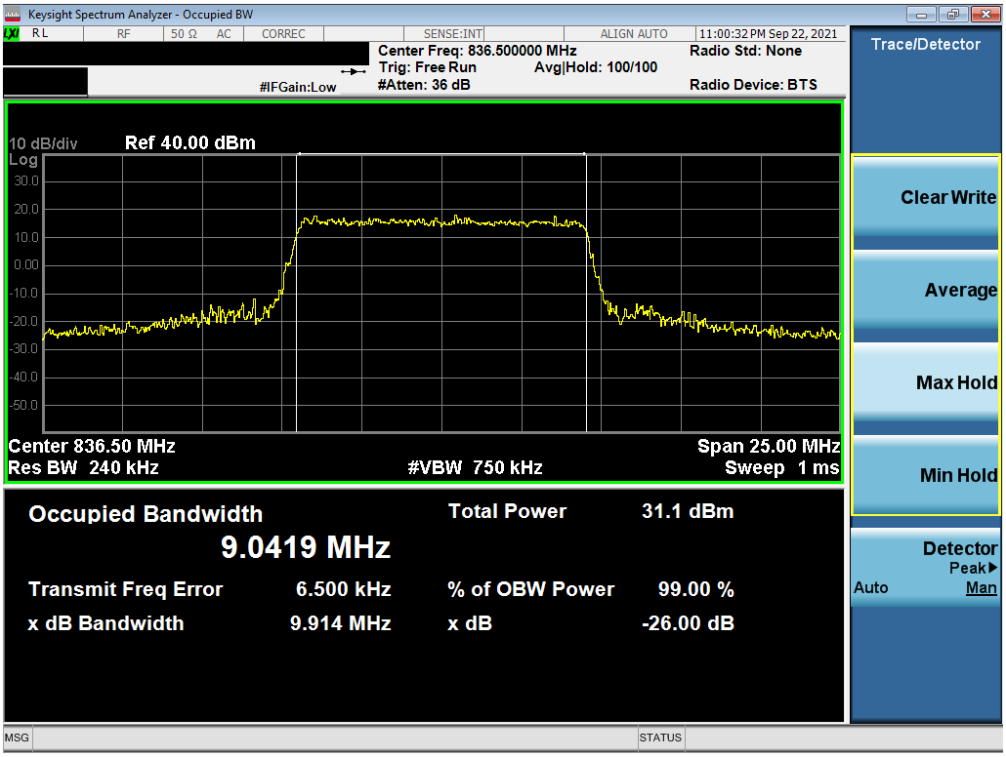
Plot 7-1. Occupied Bandwidth Plot (LTE Band 26 - 15MHz QPSK - Full RB)



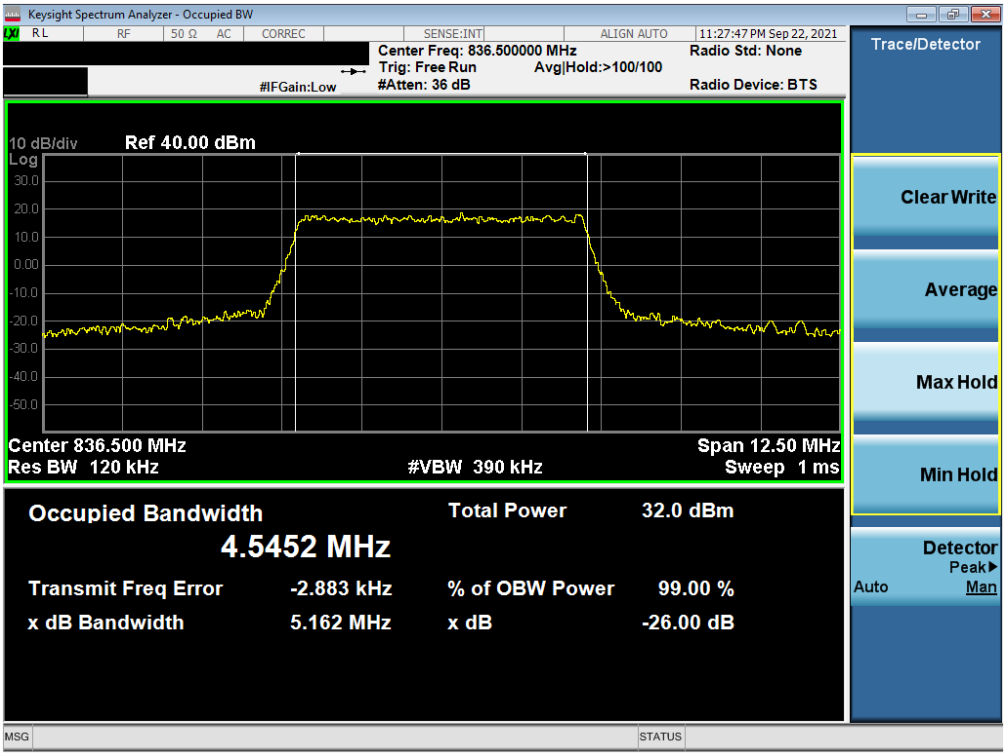
Plot 7-2. Occupied Bandwidth Plot (LTE Band 26 - 15MHz 16-QAM - Full RB)



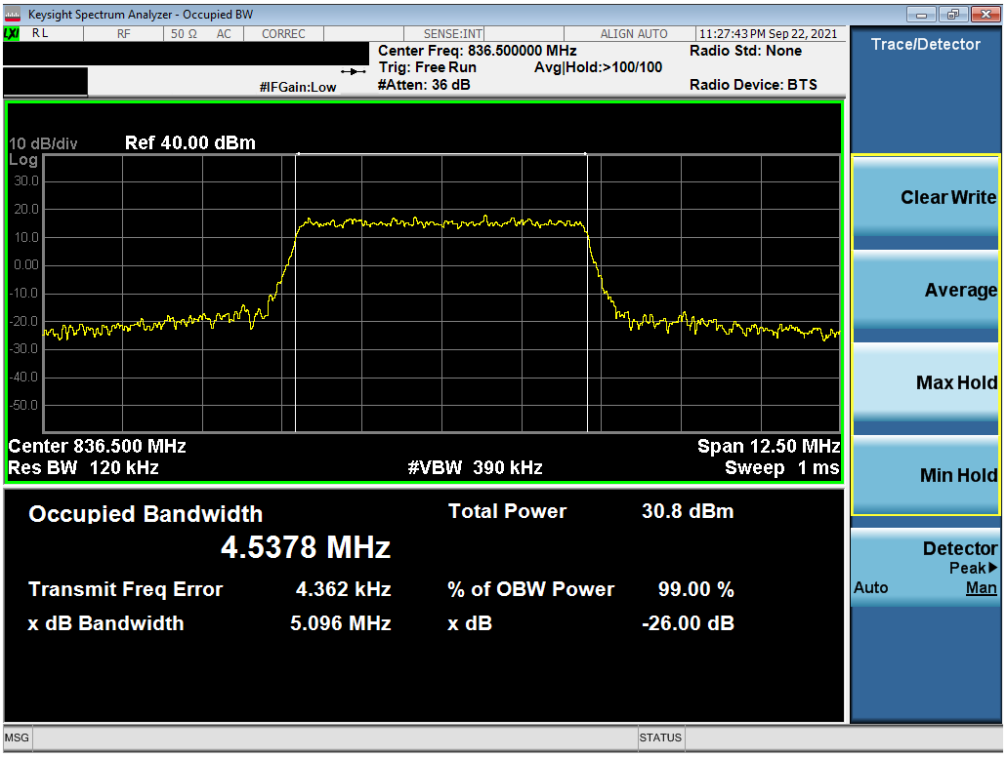
Plot 7-3. Occupied Bandwidth Plot (LTE Band 26/5 - 10MHz QPSK - Full RB)



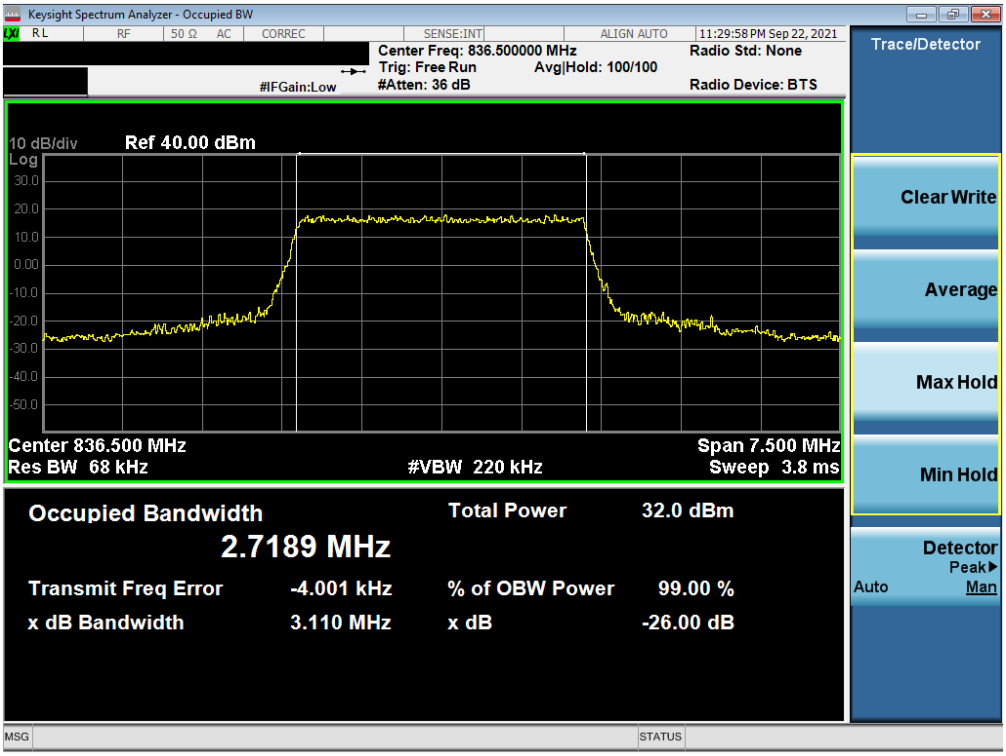
Plot 7-4. Occupied Bandwidth Plot (LTE Band 26/5 - 10MHz 16-QAM - Full RB)



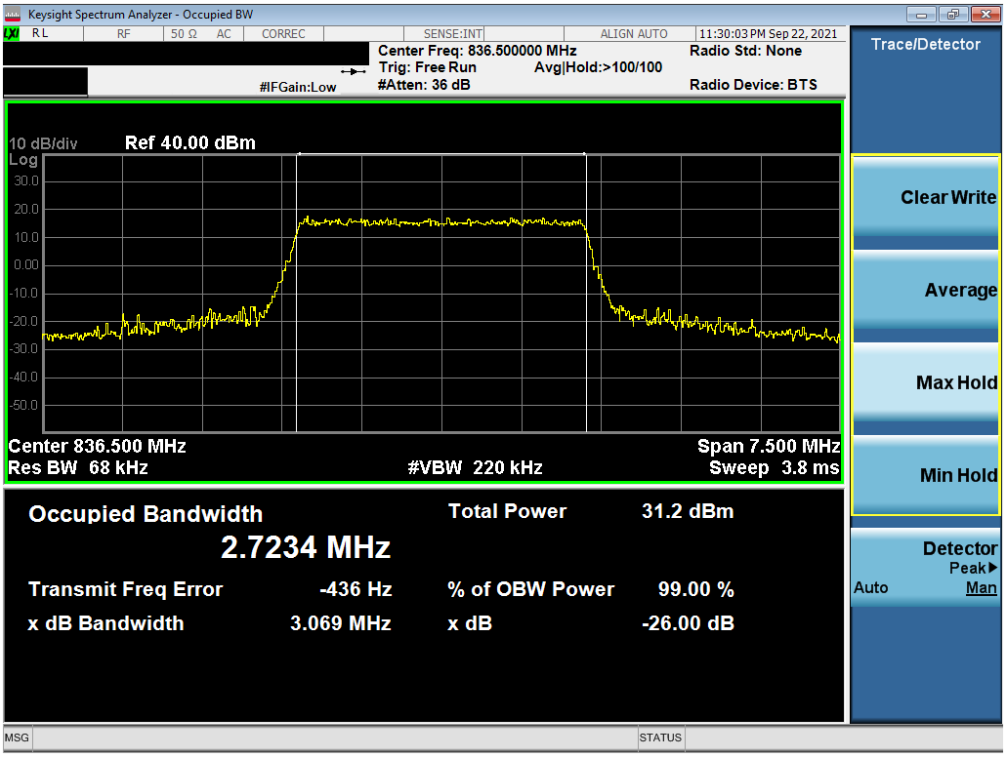
Plot 7-5. Occupied Bandwidth Plot (LTE Band 26/5 - 5MHz QPSK - Full RB)



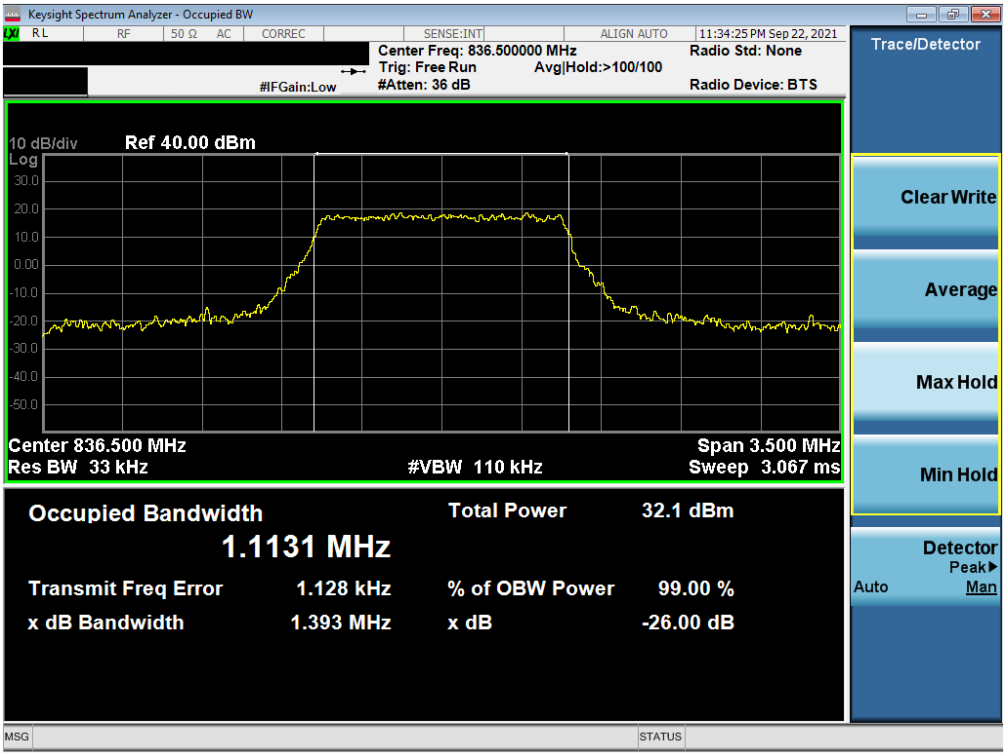
Plot 7-6. Occupied Bandwidth Plot (LTE Band 26/5 - 5MHz 16-QAM - Full RB)



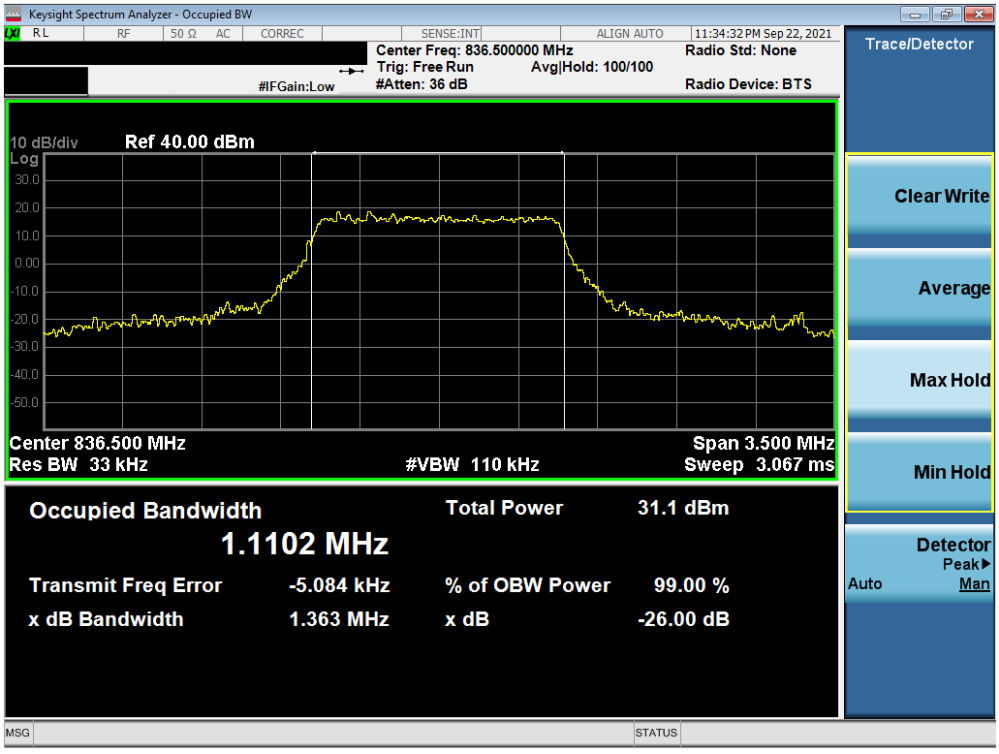
Plot 7-7. Occupied Bandwidth Plot (LTE Band 26/5 - 3MHz QPSK - Full RB)



Plot 7-8. Occupied Bandwidth Plot (LTE Band 26/5 - 3MHz 16-QAM - Full RB)

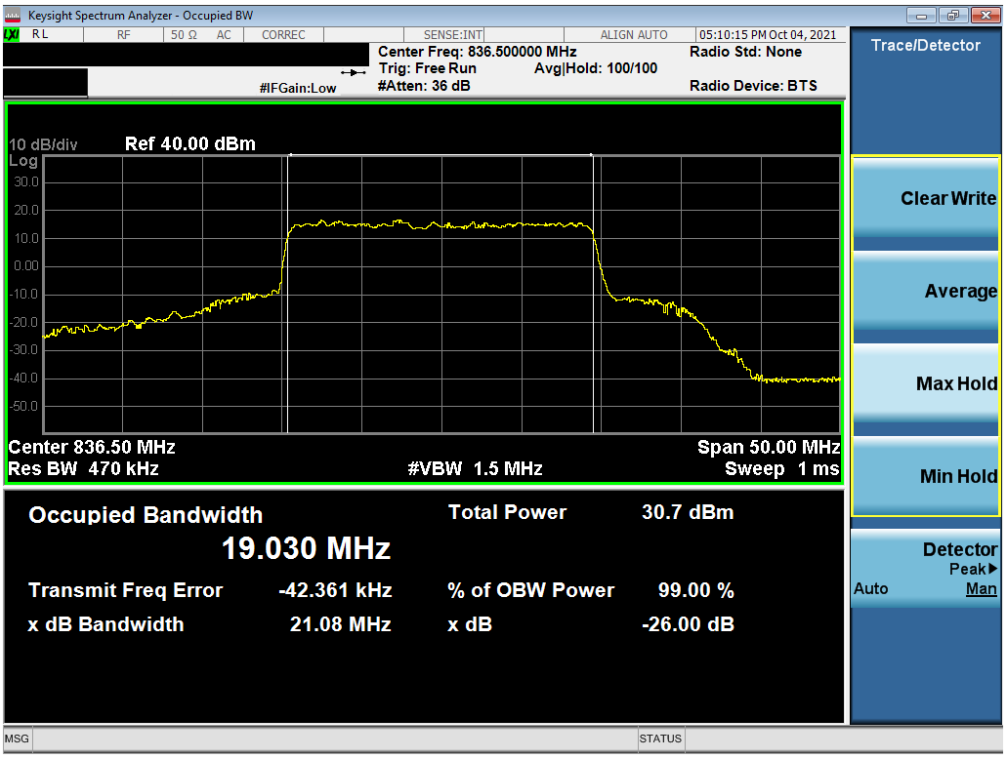


Plot 7-9. Occupied Bandwidth Plot (LTE Band 26/5 - 1.4MHz QPSK - Full RB)

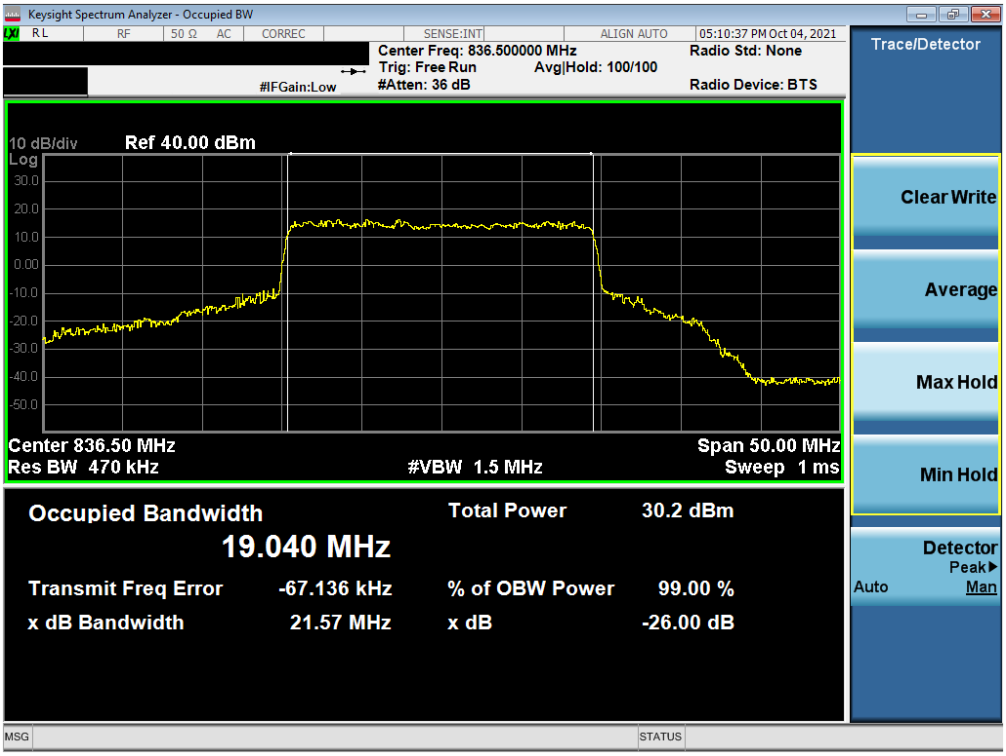


Plot 7-10. Occupied Bandwidth Plot (LTE Band 26/5 - 1.4MHz 16-QAM - Full RB)

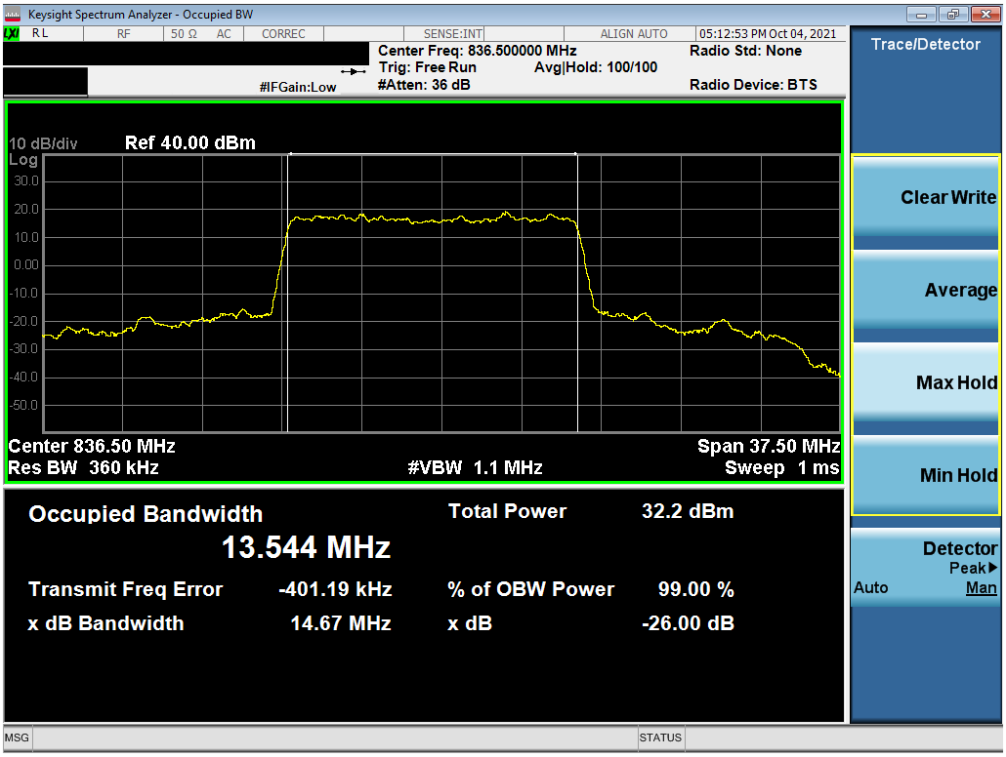
Plot 7-11. Occupied Bandwidth Plot (NR Band n5 - 20MHz π/2 BPSK - Full RB)



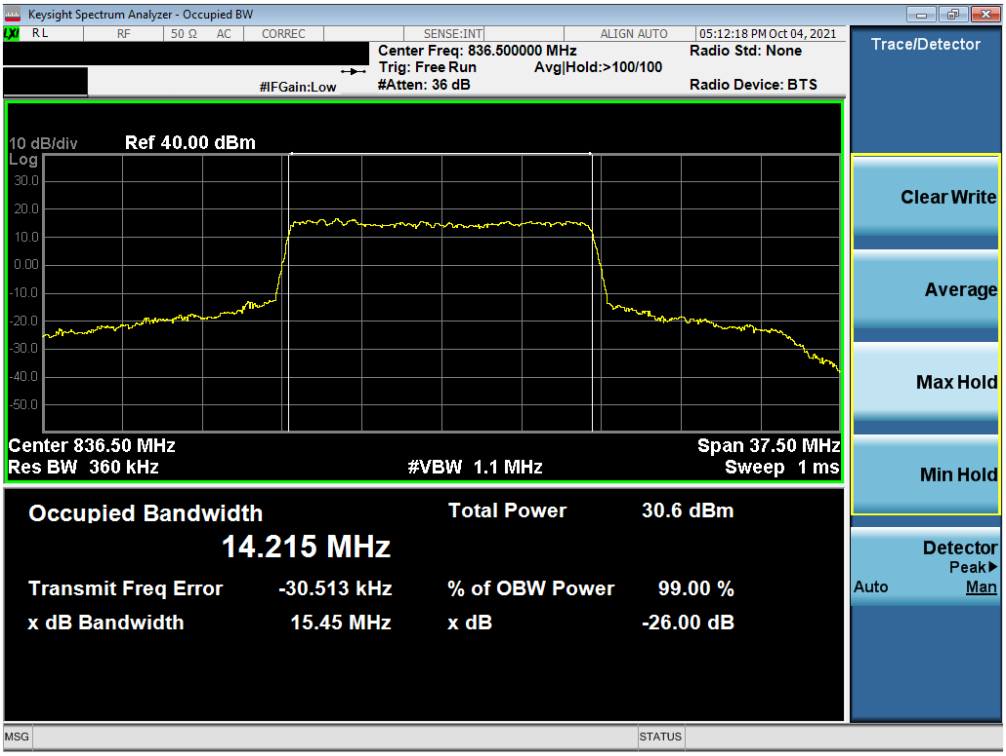
Plot 7-12. Occupied Bandwidth Plot (NR Band n5 - 20MHz QPSK - Full RB)



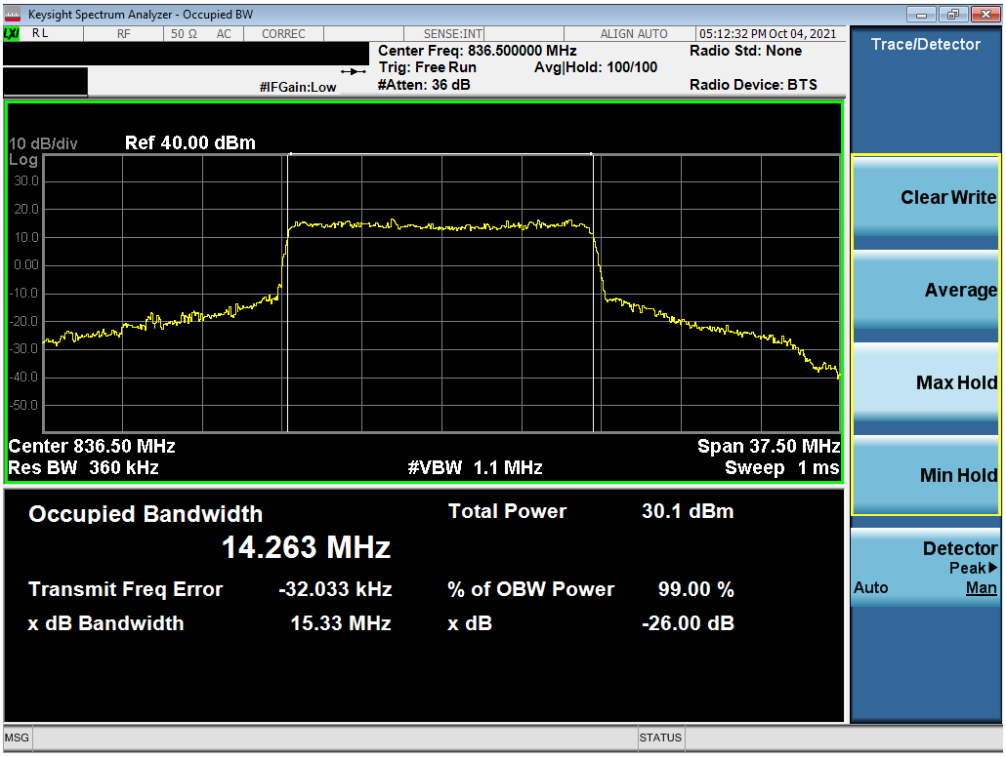
Plot 7-13. Occupied Bandwidth Plot (NR Band n5 - 20MHz 16-QAM - Full RB)



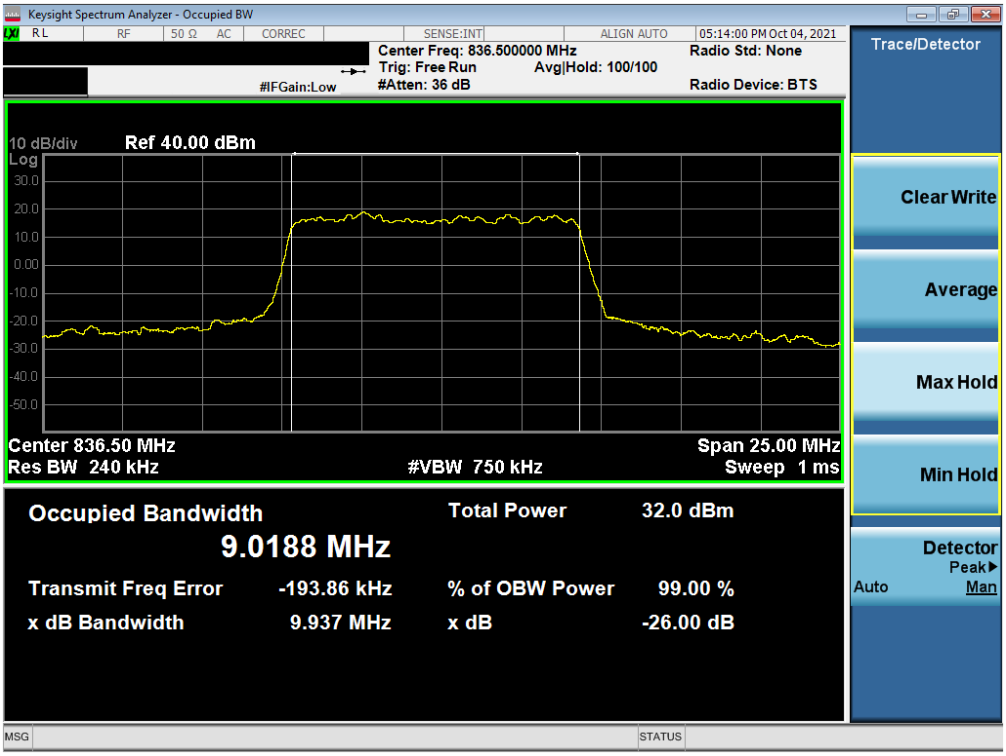
Plot 7-14. Occupied Bandwidth Plot (NR Band n5 - 15MHz π/2 BPSK - Full RB)



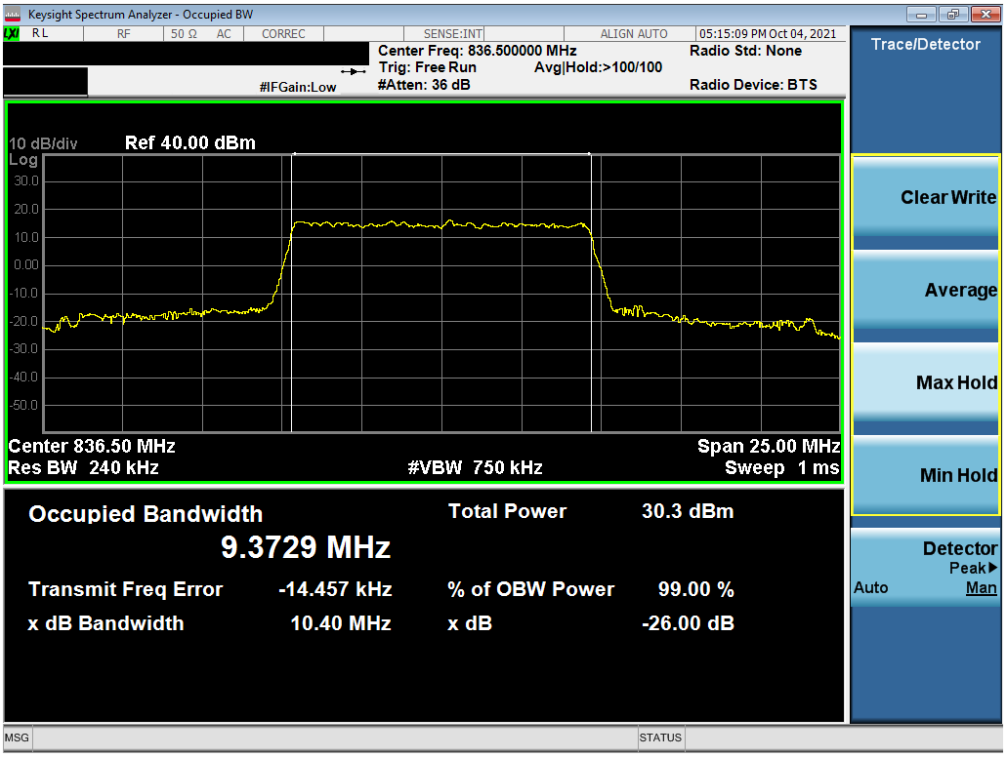
Plot 7-15. Occupied Bandwidth Plot (NR Band n5 - 15MHz QPSK - Full RB)



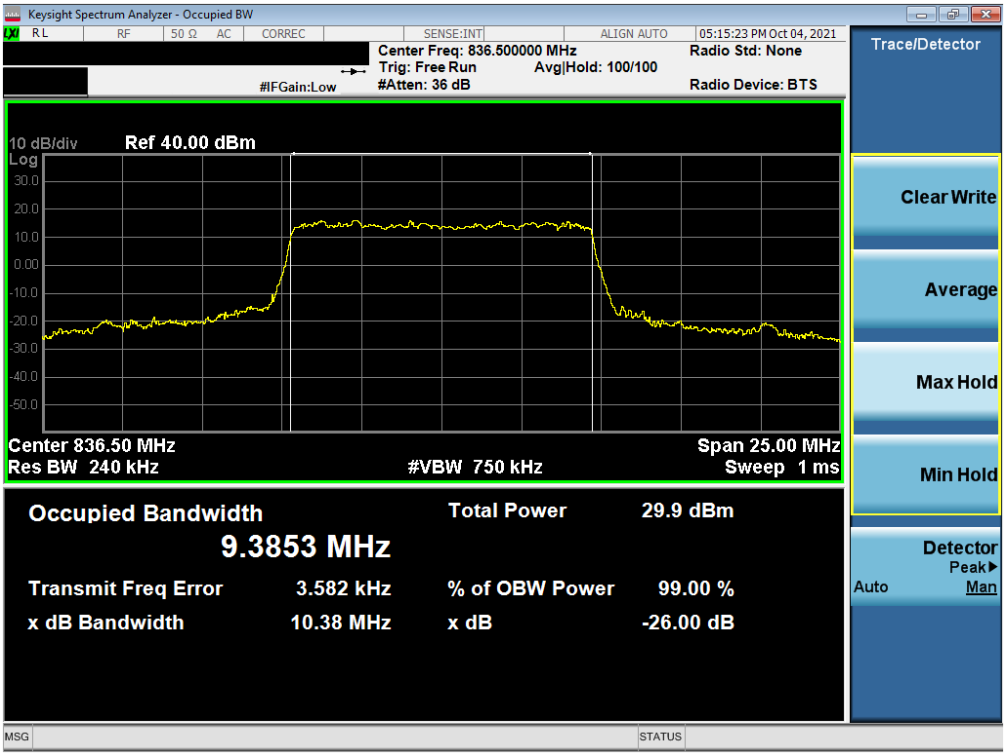
Plot 7-16. Occupied Bandwidth Plot (NR Band n5 - 15MHz 16-QAM - Full RB)



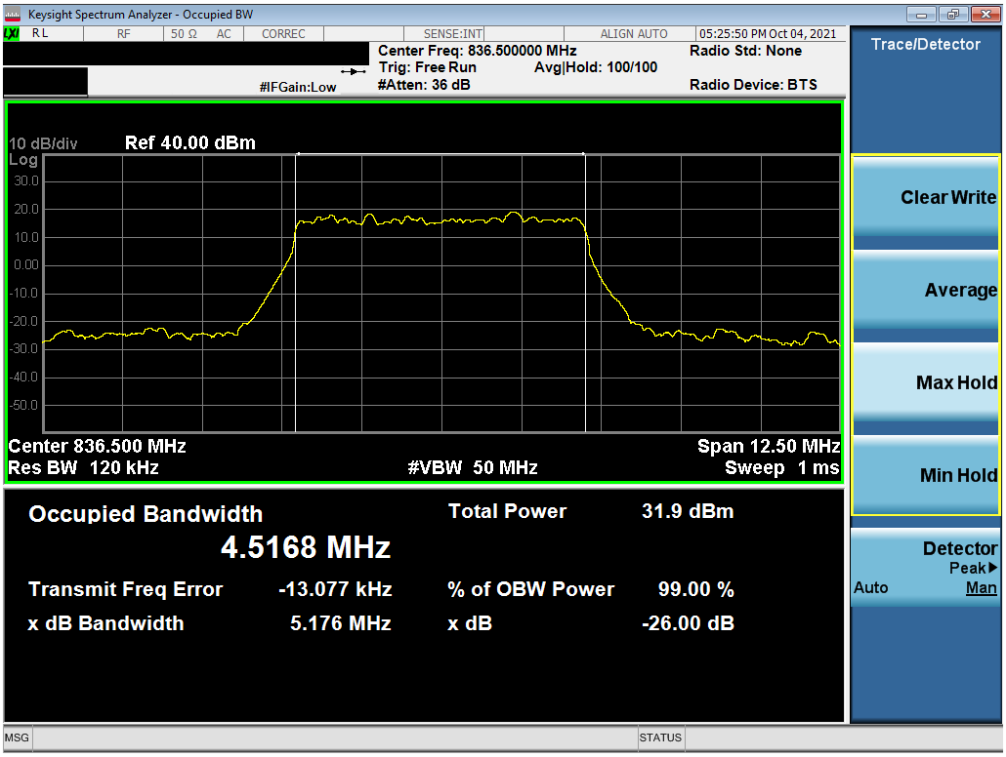
Plot 7-17. Occupied Bandwidth Plot (NR Band n5 - 10MHz π/2 BPSK - Full RB)



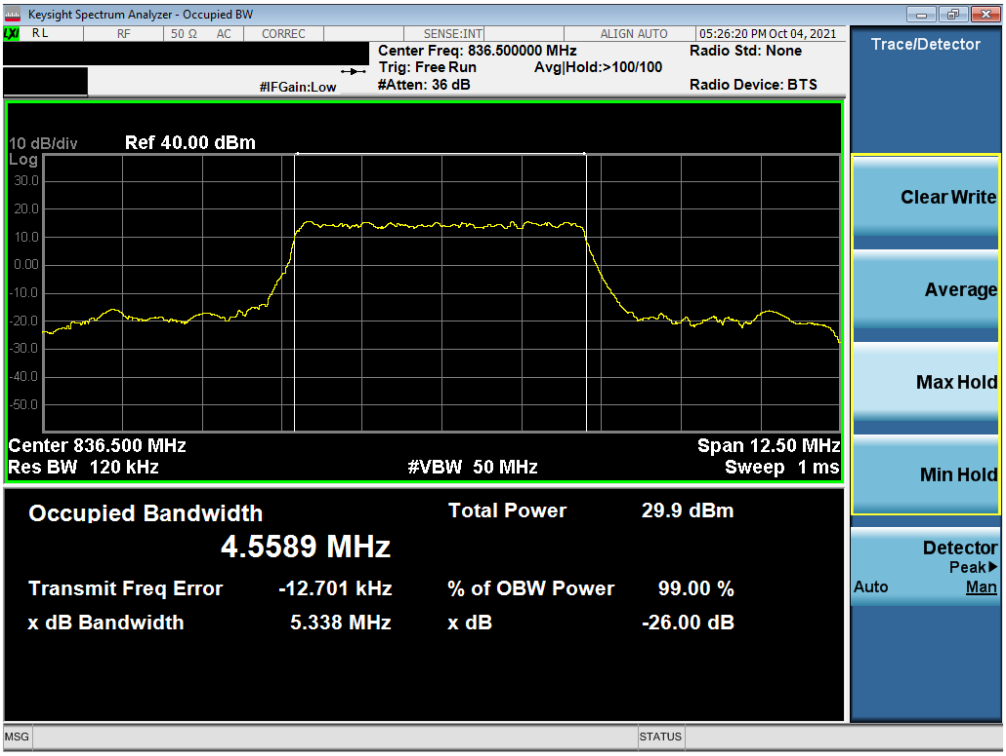
Plot 7-18. Occupied Bandwidth Plot (NR Band n5 - 10MHz QPSK - Full RB)



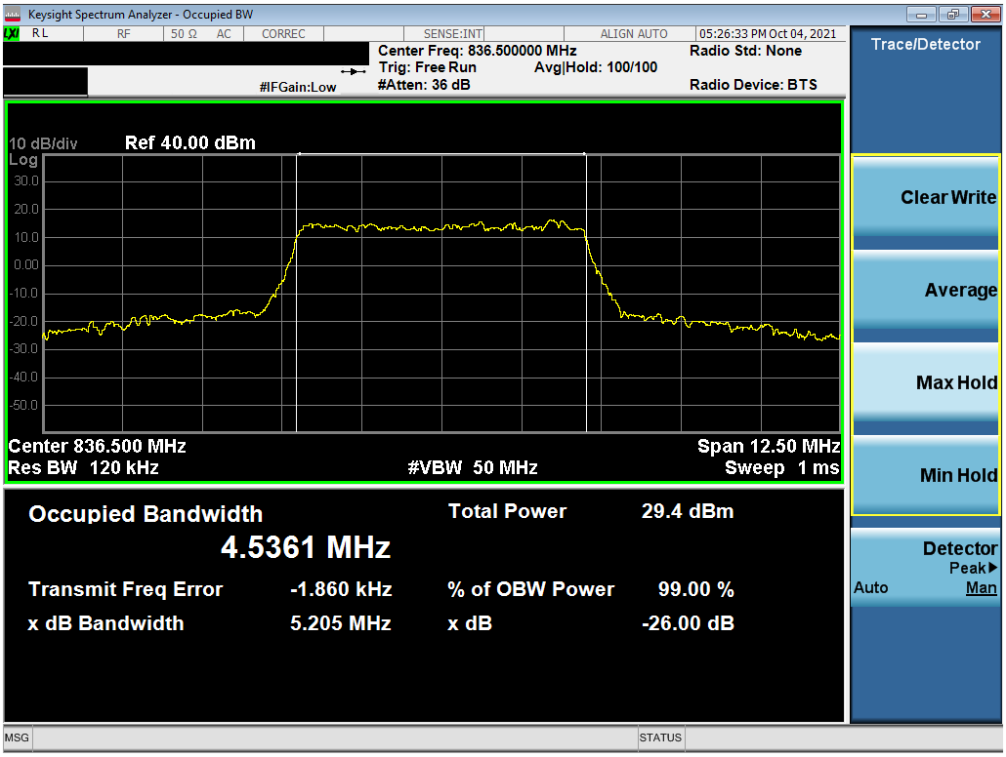
Plot 7-19. Occupied Bandwidth Plot (NR Band n5 - 10MHz 16-QAM - Full RB)



Plot 7-20. Occupied Bandwidth Plot (NR Band n5 - 5MHz π/2 BPSK - Full RB)



Plot 7-21. Occupied Bandwidth Plot (NR Band n5 - 5MHz QPSK - Full RB)



Plot 7-22. Occupied Bandwidth Plot (NR Band n5 - 5MHz 16-QAM - Full RB)

GPRS Cell

Plot 7-23. Occupied Bandwidth Plot (GPRS, Ch. 190)

Plot 7-24. Occupied Bandwidth Plot (EDGE, Ch. 190)

WCDMA Cell

Plot 7-25. Occupied Bandwidth Plot (WCDMA, Ch. 4183)

7.3 Spurious and Harmonic Emissions at Antenna Terminal

Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is 43 + 10 $log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 10GHz (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

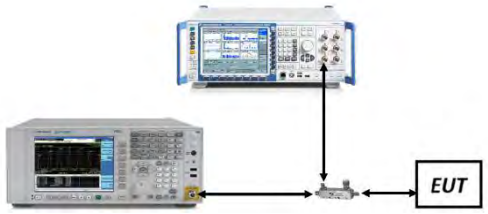


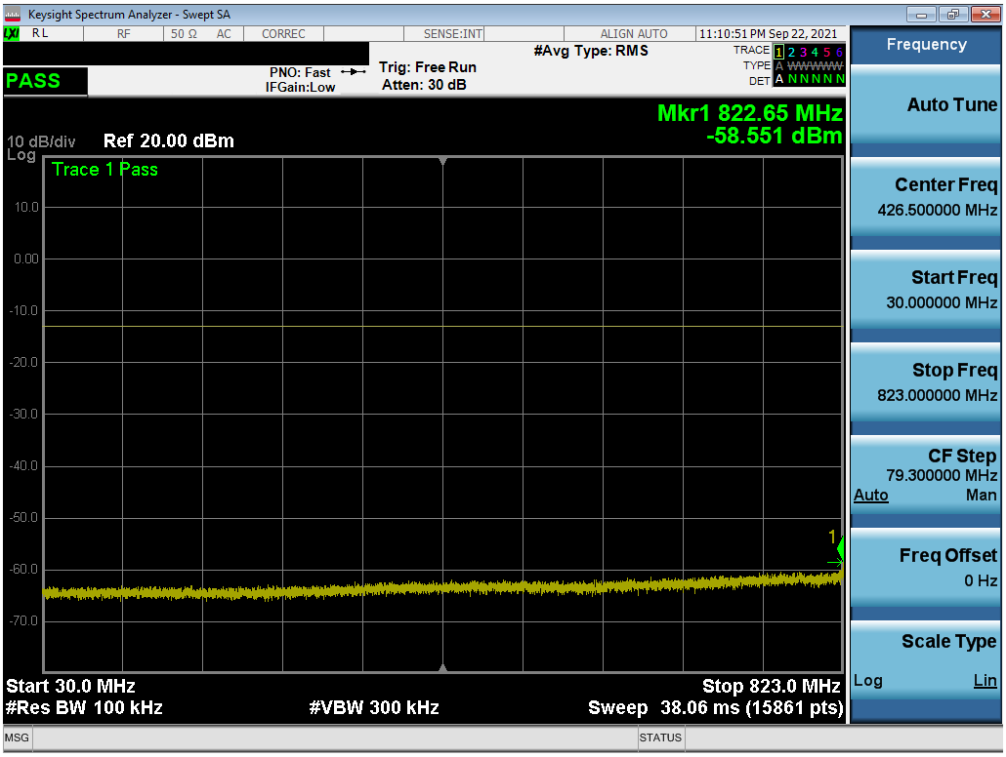
Figure 7-2. Test Instrument & Measurement Setup

Test Notes

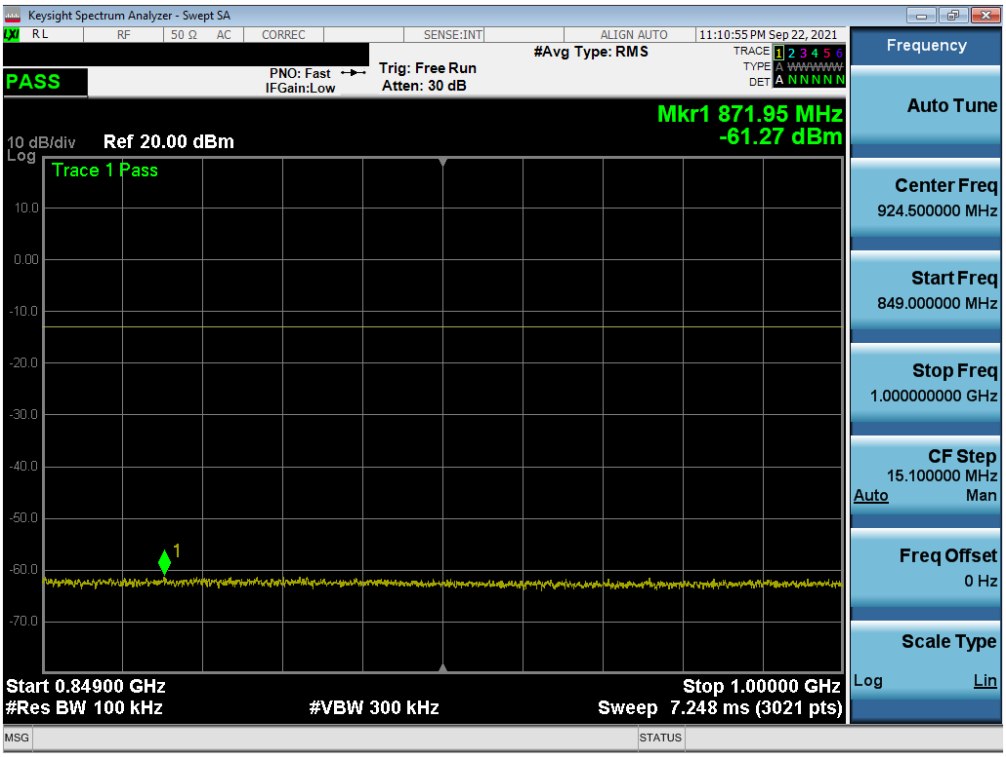
1. Per Part 22 and RSS-132, compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth 100 kHz or greater for measurements below 1GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

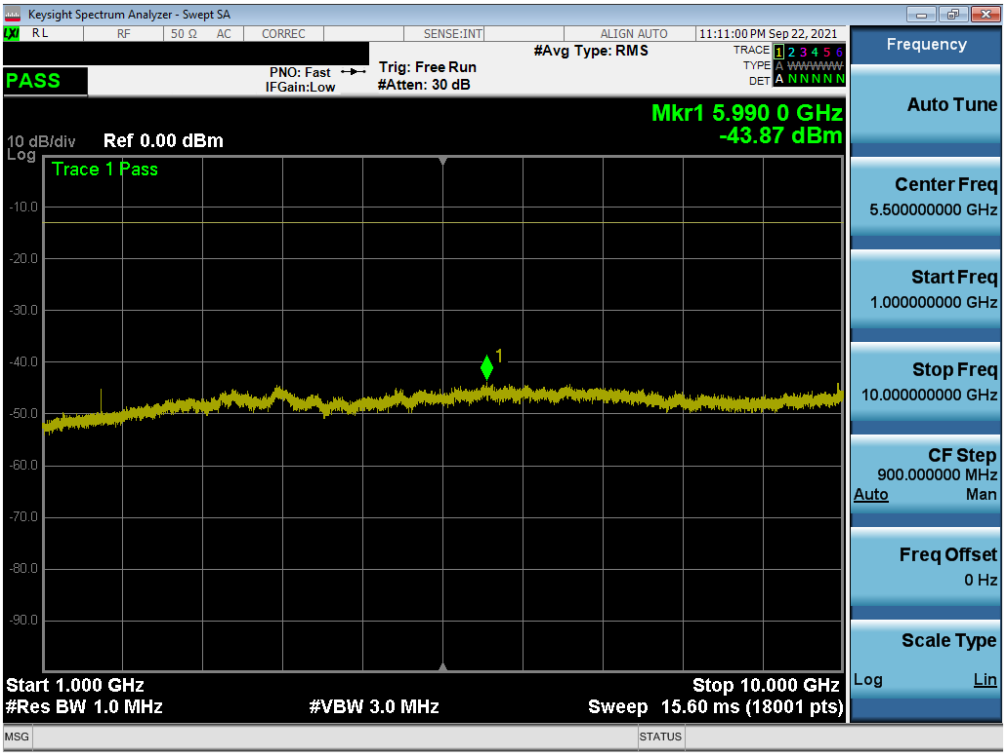
LTE Band 26/5



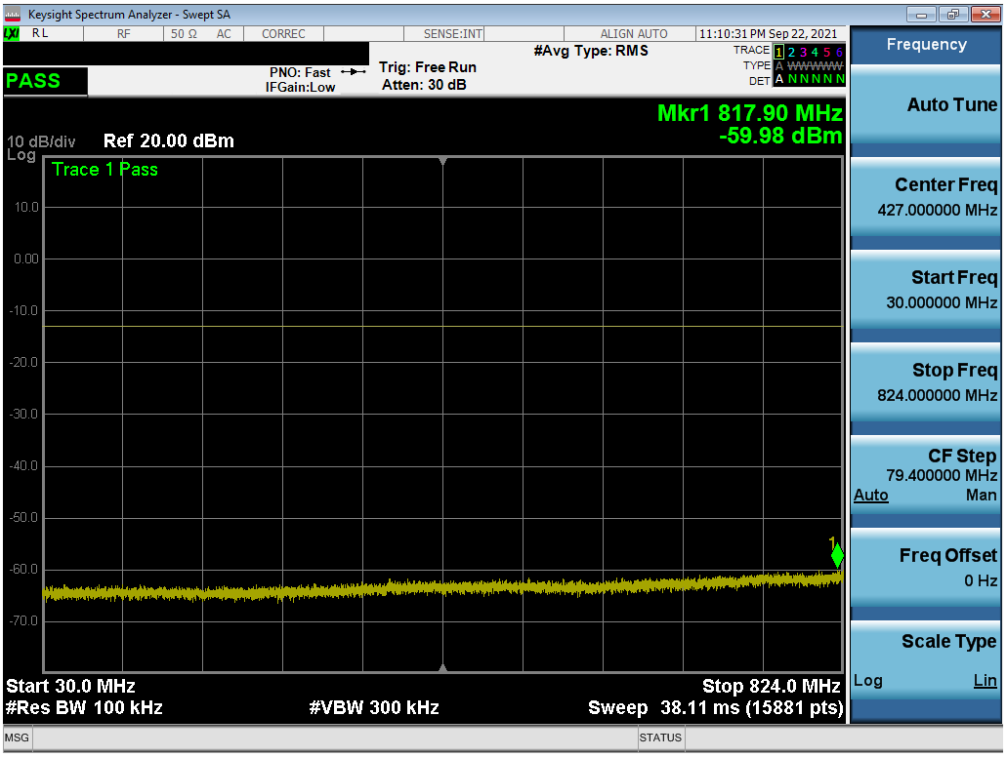
Plot 7-26. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK – 1 RB - Low Channel)



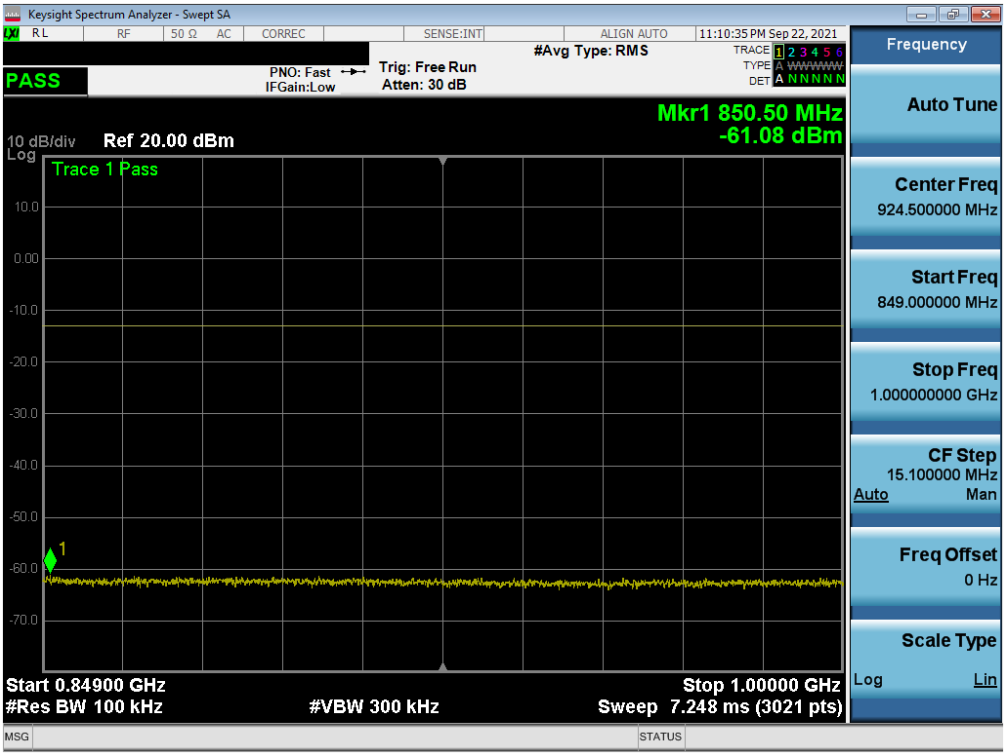
Plot 7-27. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - 1 RB - Low Channel)



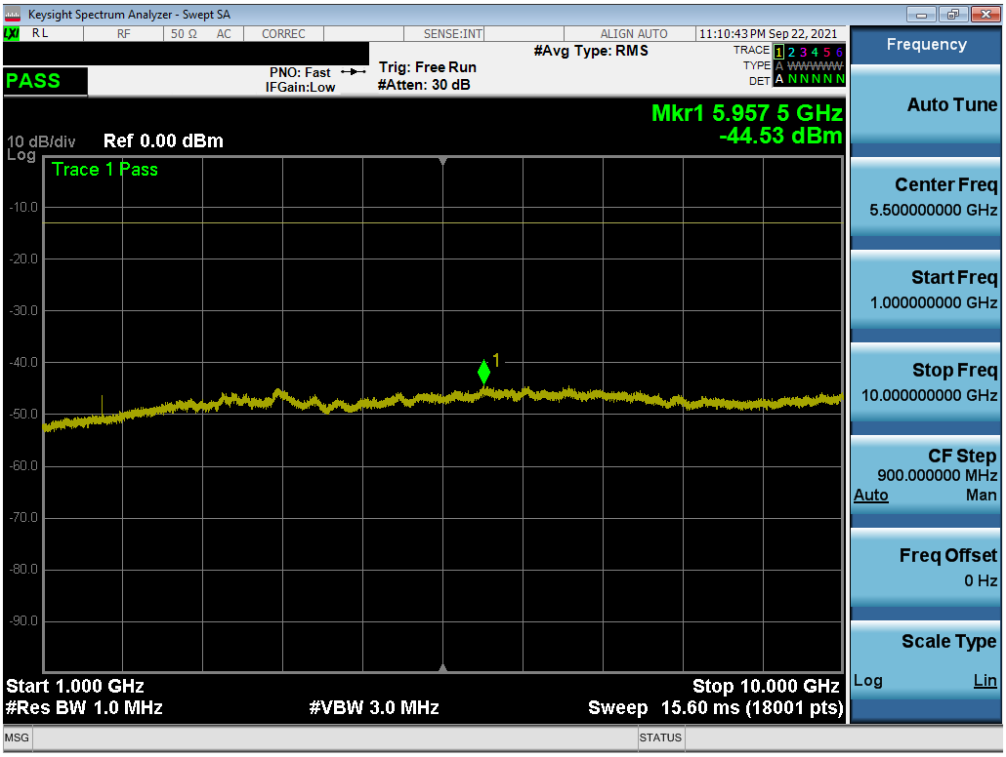
Plot 7-28. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - 1 RB - Low Channel)



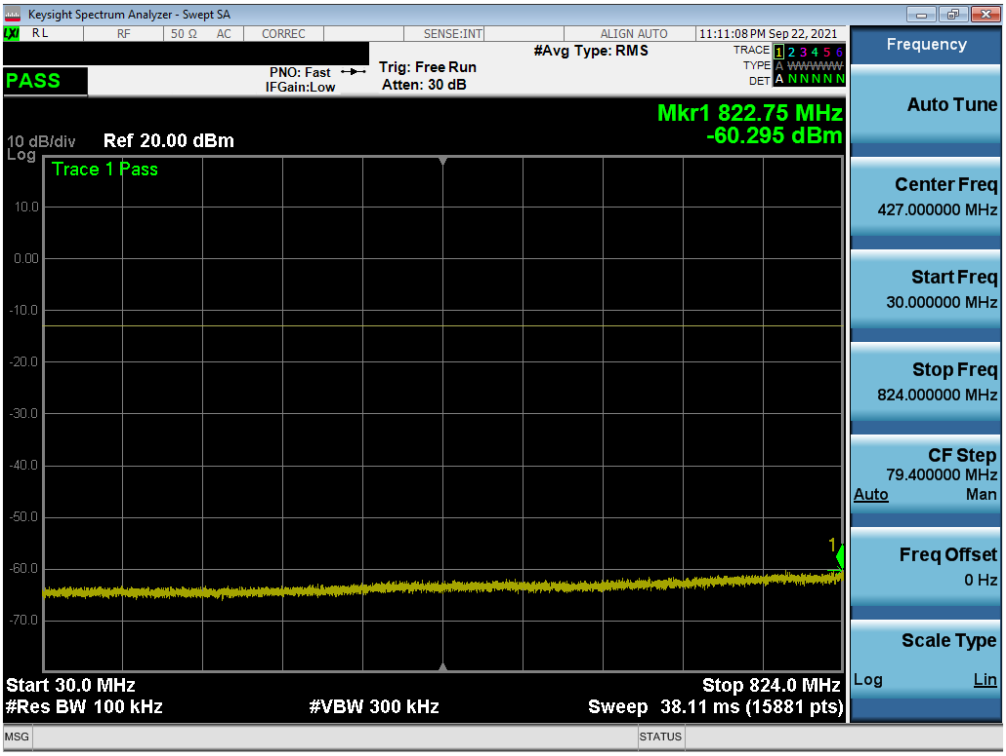
Plot 7-29. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - 1 RB - Mid Channel)



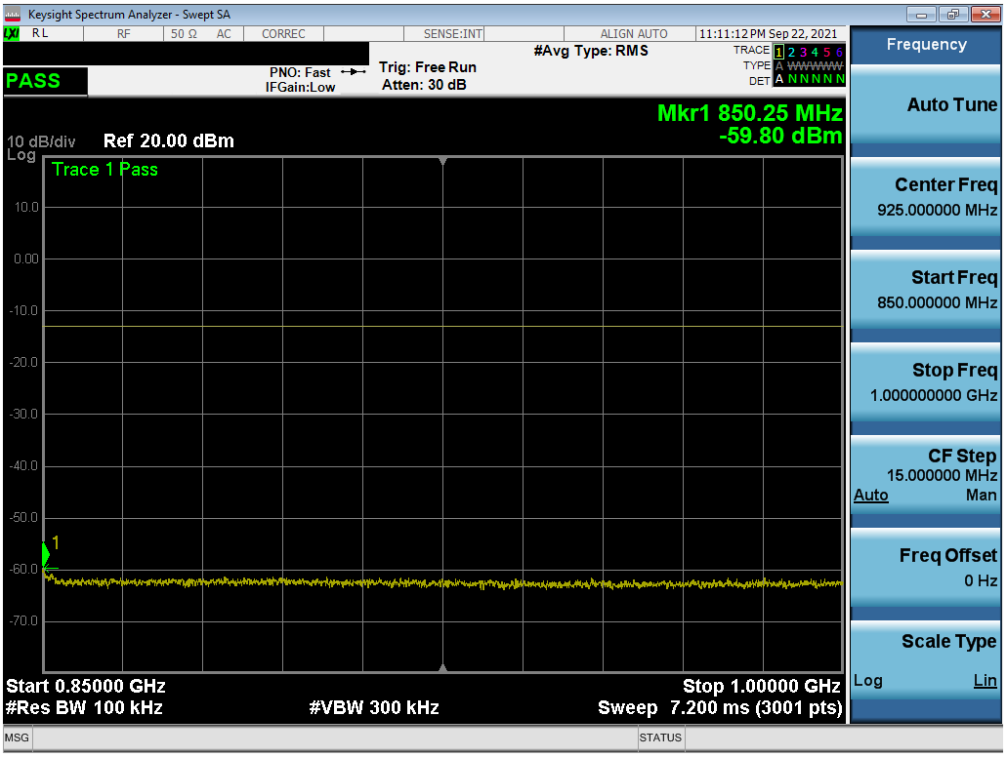
Plot 7-30. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - 1 RB - Mid Channel)



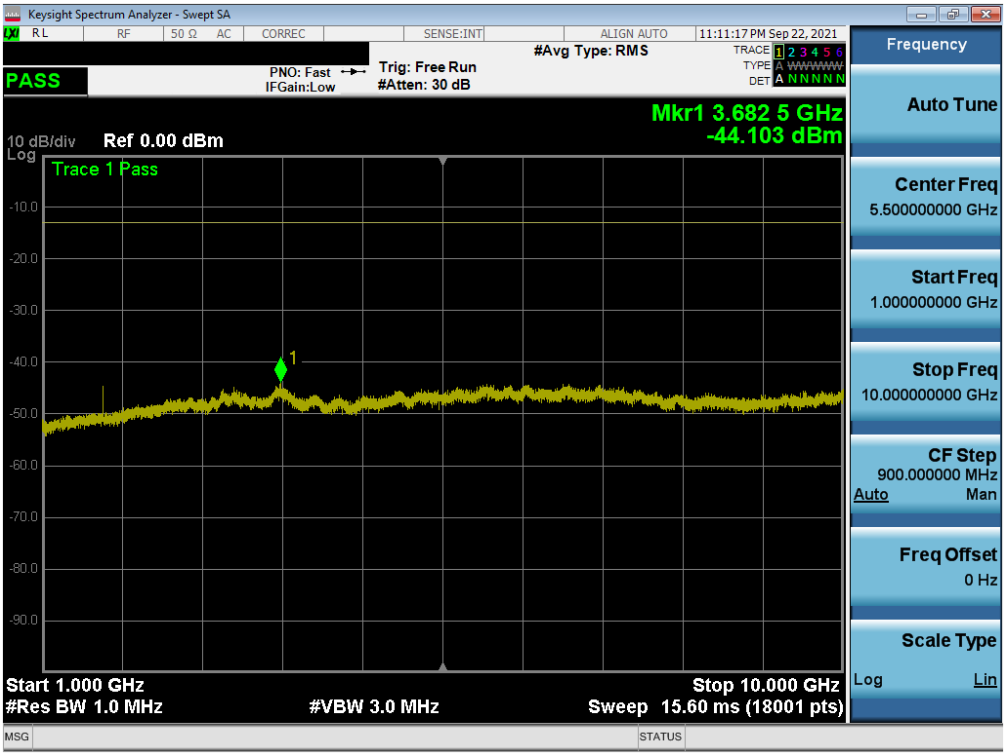
Plot 7-31. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - 1 RB - Mid Channel)



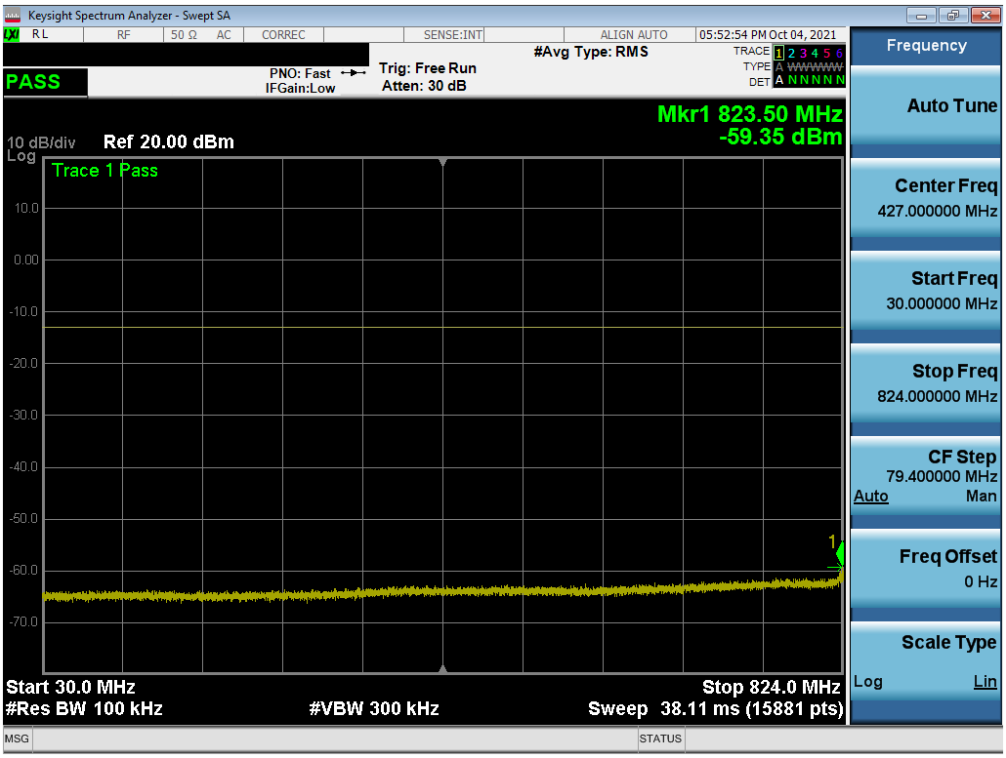
Plot 7-32. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - 1 RB - High Channel)



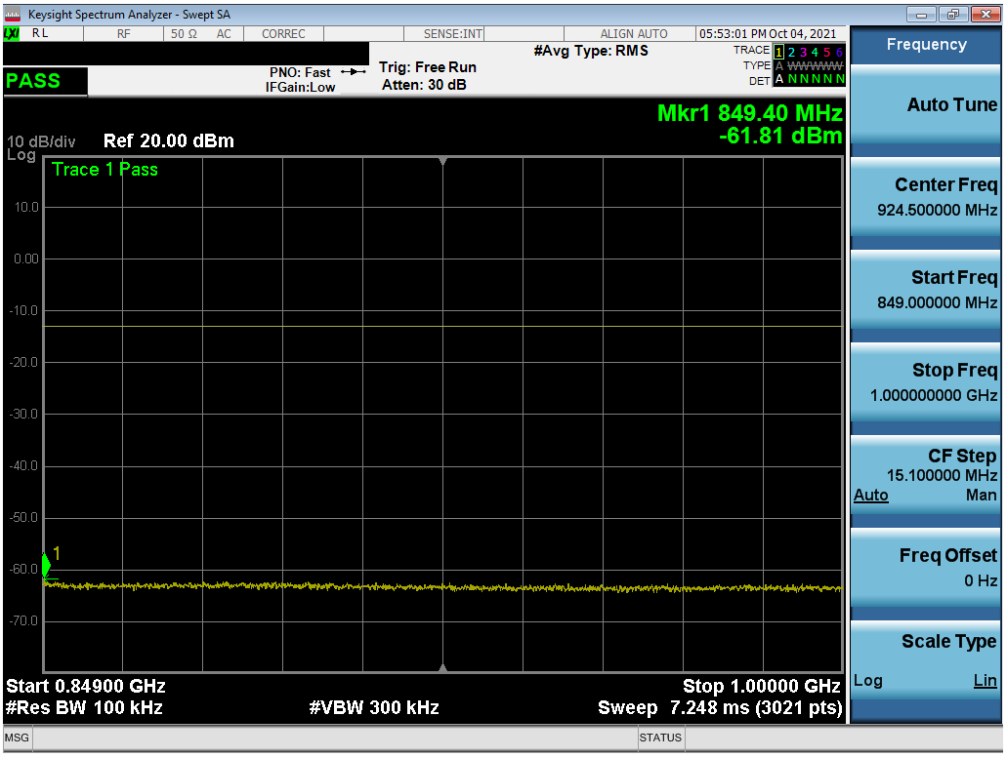
Plot 7-33. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - 1 RB - High Channel)



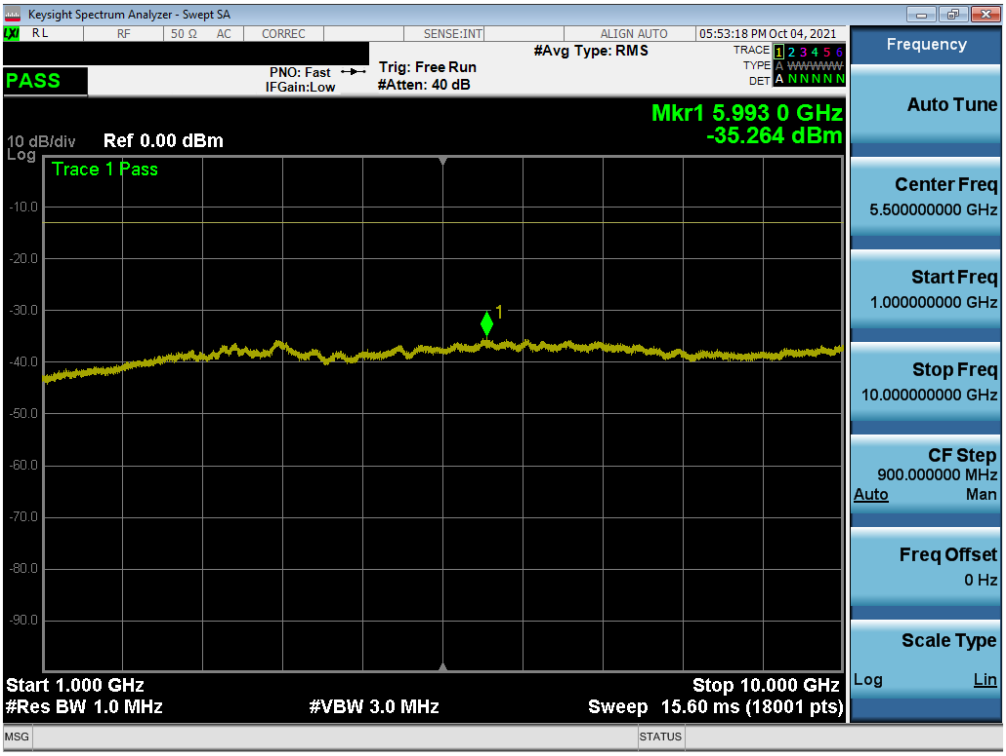
Plot 7-34. Conducted Spurious Plot (LTE Band 26/5 - 10MHz QPSK - 1 RB - High Channel)



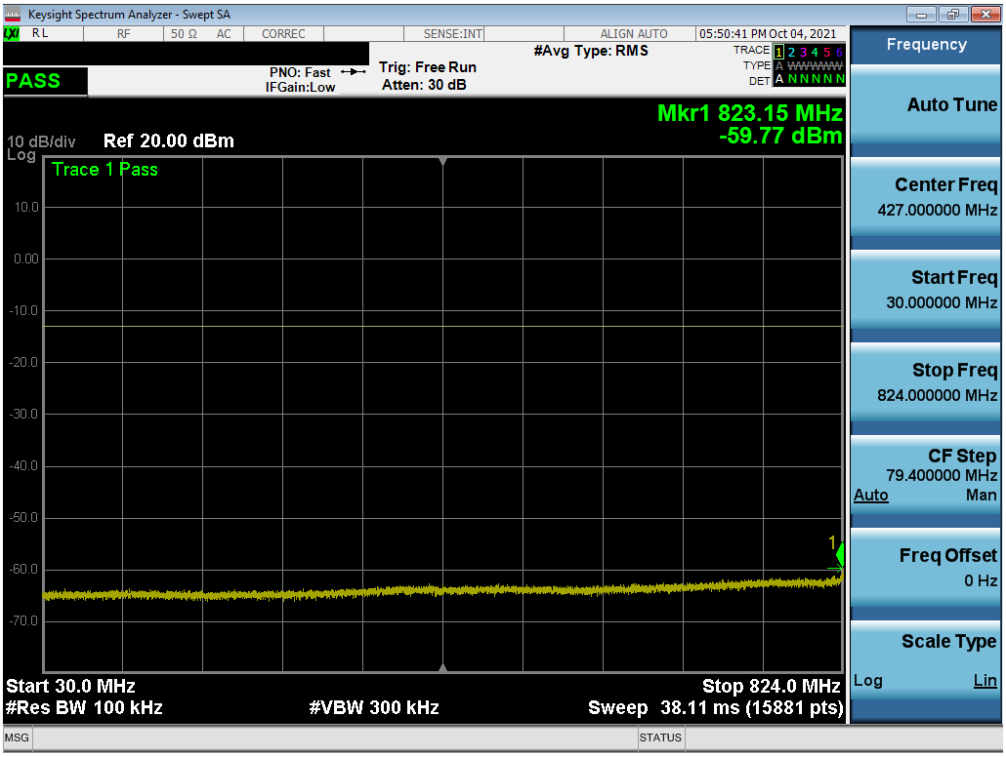
Plot 7-35. Conducted Spurious Plot (NR Band n5 - 20.0MHz - 1 RB - Low Channel)



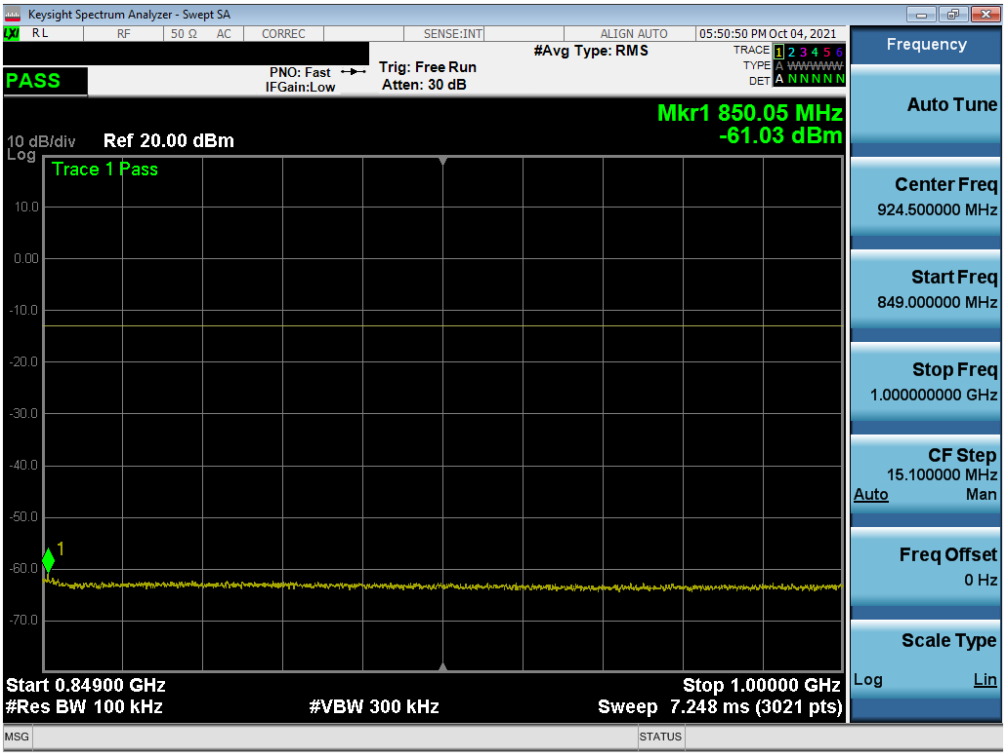
Plot 7-36. Conducted Spurious Plot (NR Band n5 - 20.0MHz - 1 RB - Low Channel)



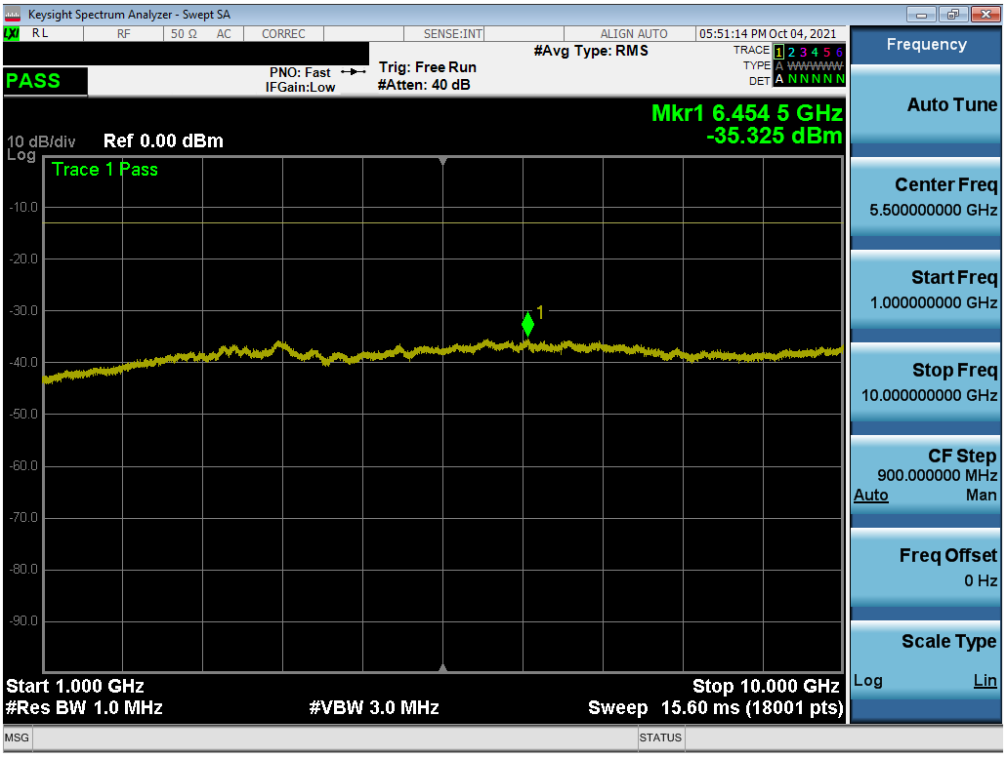
Plot 7-37. Conducted Spurious Plot (NR Band n5 - 20.0MHz - 1 RB - Low Channel)



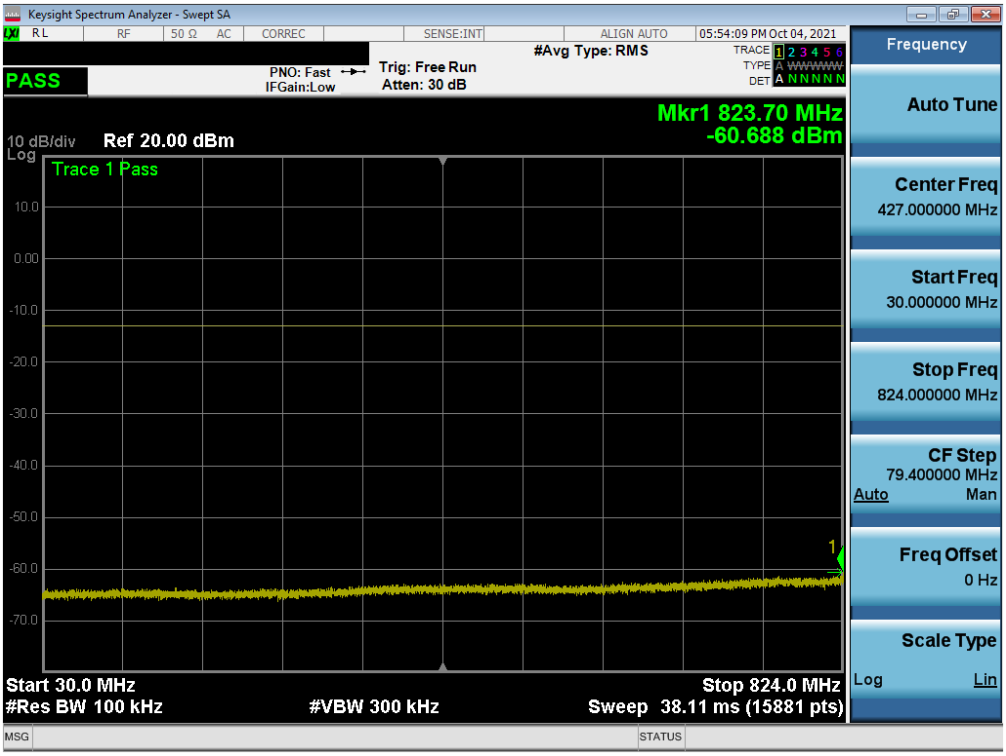
Plot 7-38. Conducted Spurious Plot (NR Band n5 - 20.0MHz - 1 RB - Mid Channel)



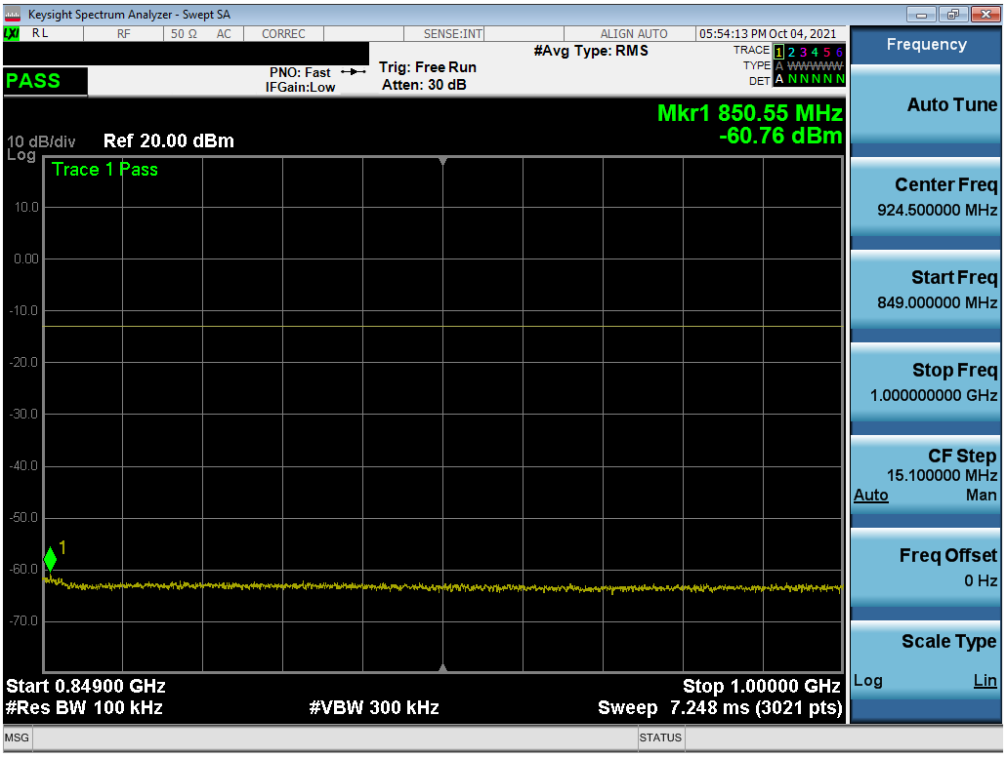
Plot 7-39. Conducted Spurious Plot (NR Band n5 - 20.0MHz - 1 RB - Mid Channel)



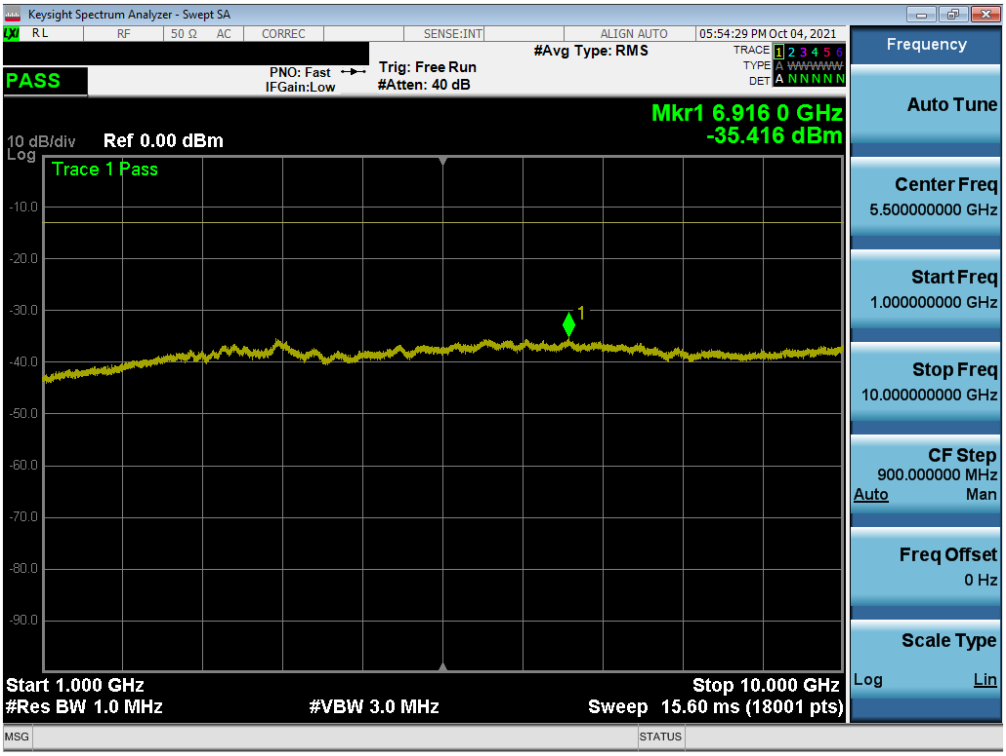
Plot 7-40. Conducted Spurious Plot (NR Band n5 - 20.0MHz - 1 RB - Mid Channel)



Plot 7-41. Conducted Spurious Plot (NR Band n5 - 20.0MHz - 1 RB - High Channel)

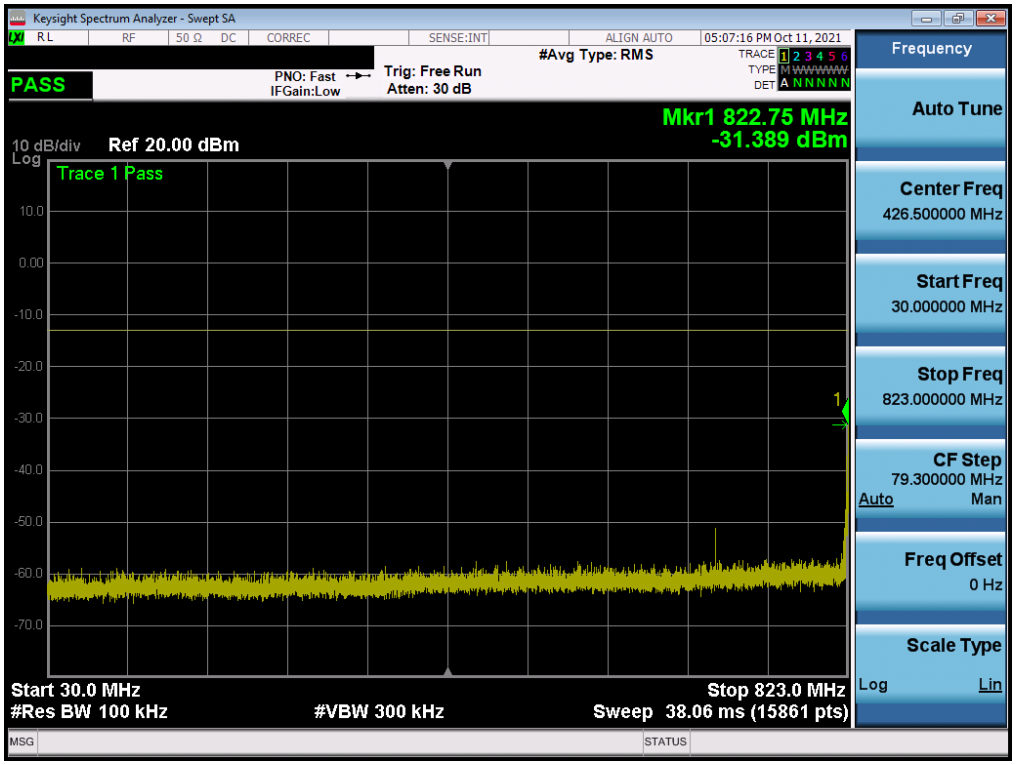


Plot 7-42. Conducted Spurious Plot (NR Band n5 - 20.0MHz - 1 RB - High Channel)

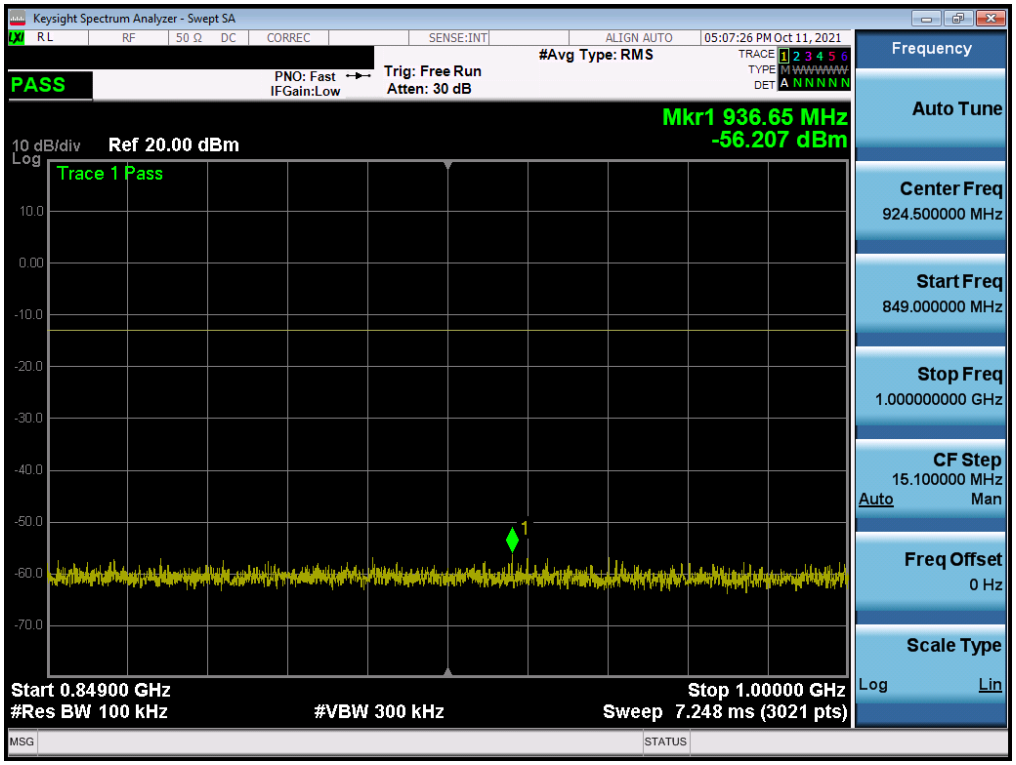


Plot 7-43. Conducted Spurious Plot (NR Band n5 - 20.0MHz - 1 RB - High Channel)

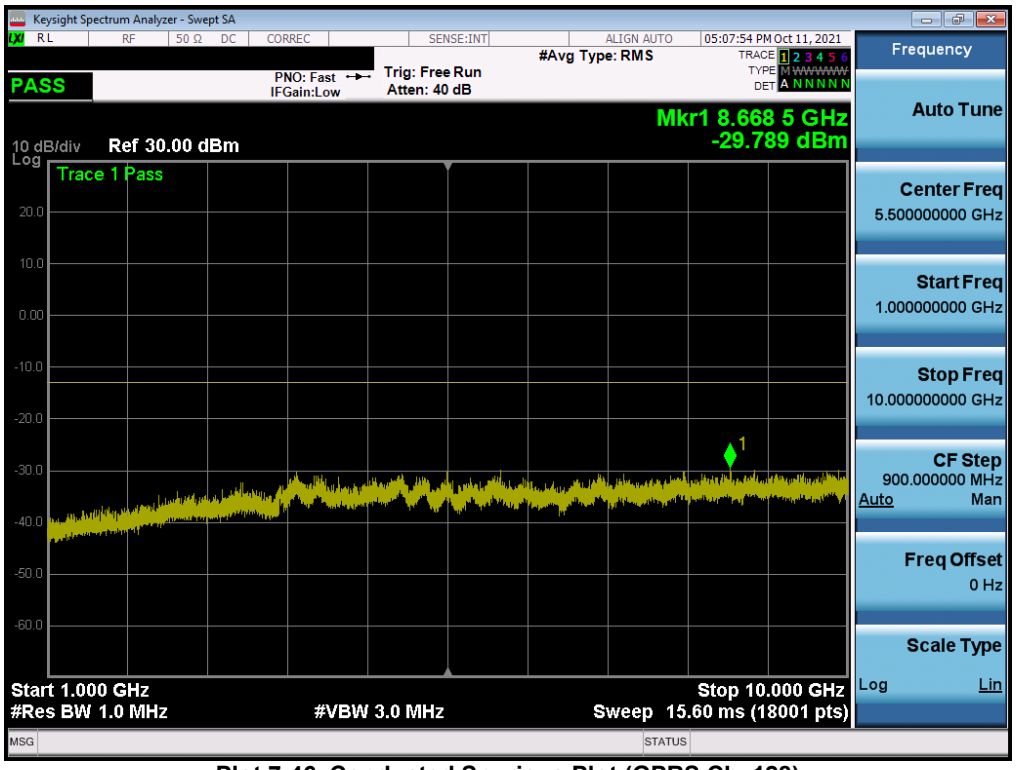
GSM/GPRS Cell – Ant1



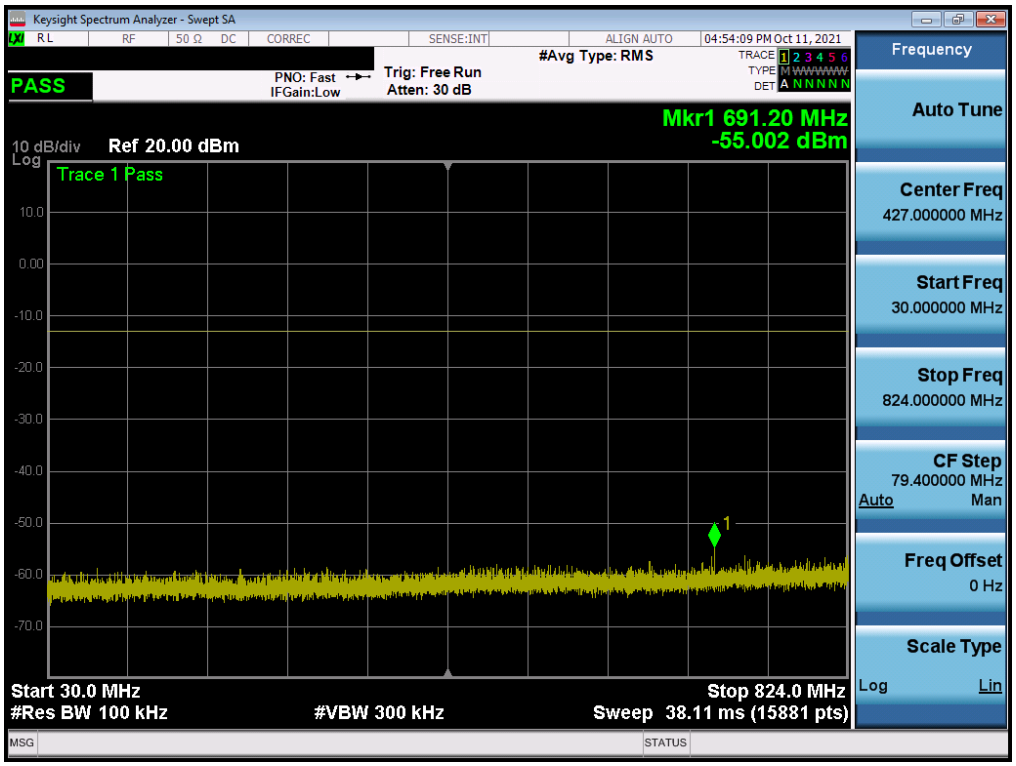
Plot 7-44. Conducted Spurious Plot (GPRS Ch. 128)



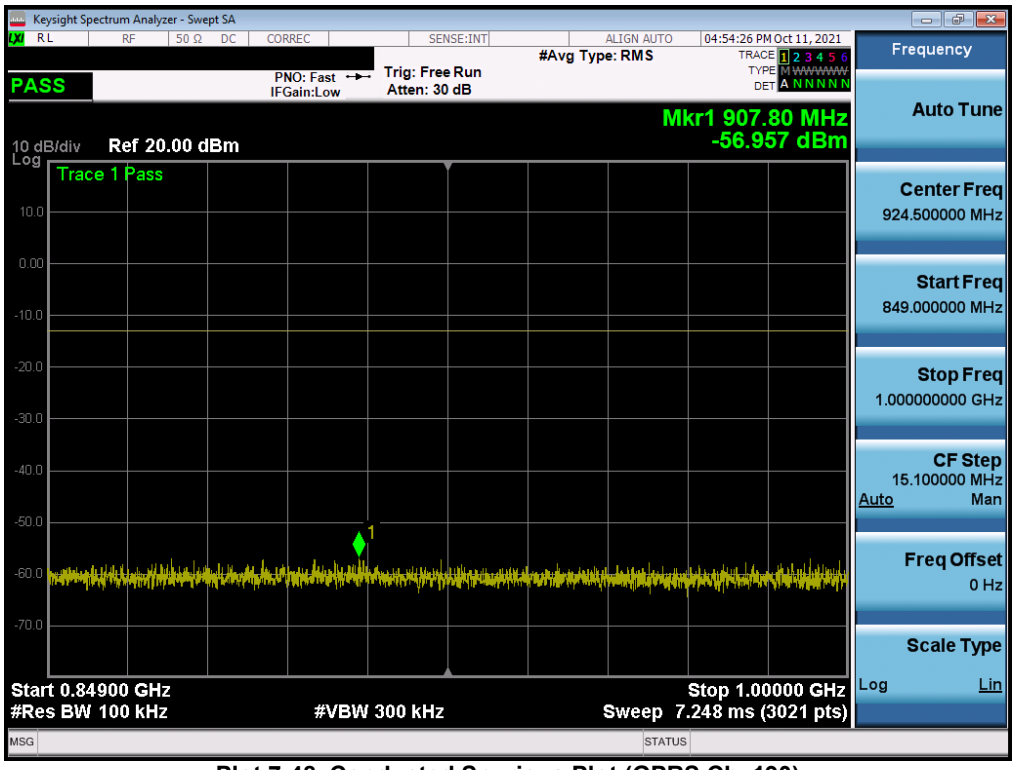
Plot 7-45. Conducted Spurious Plot (GPRS Ch. 128)



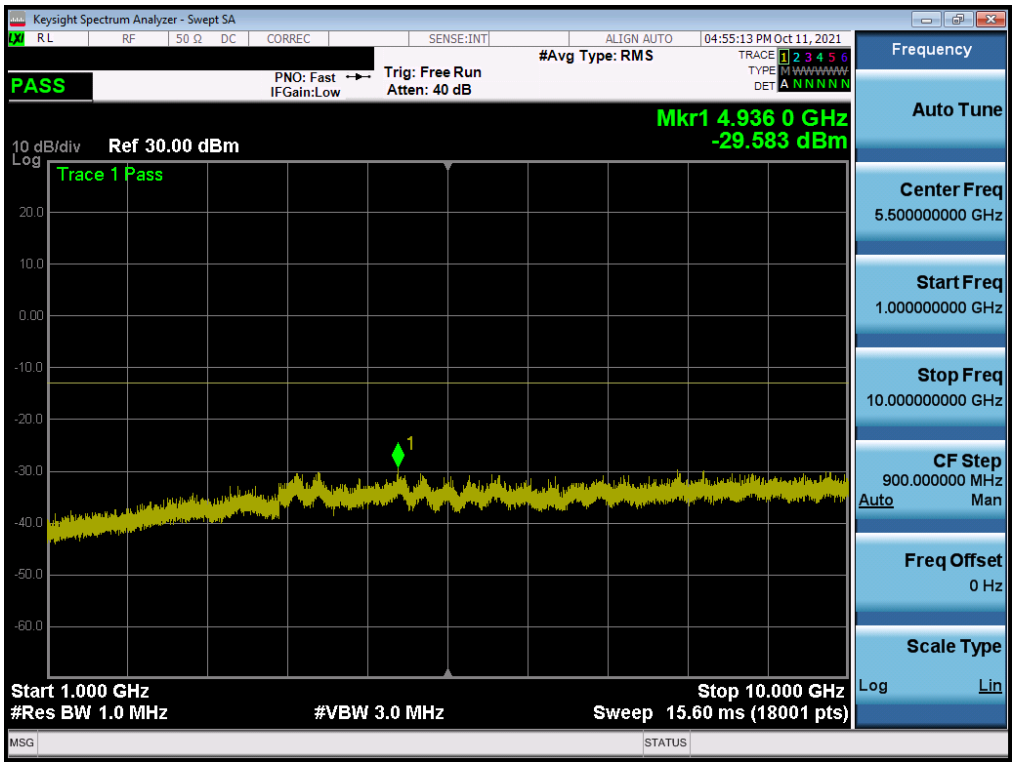
Plot 7-46. Conducted Spurious Plot (GPRS Ch. 128)



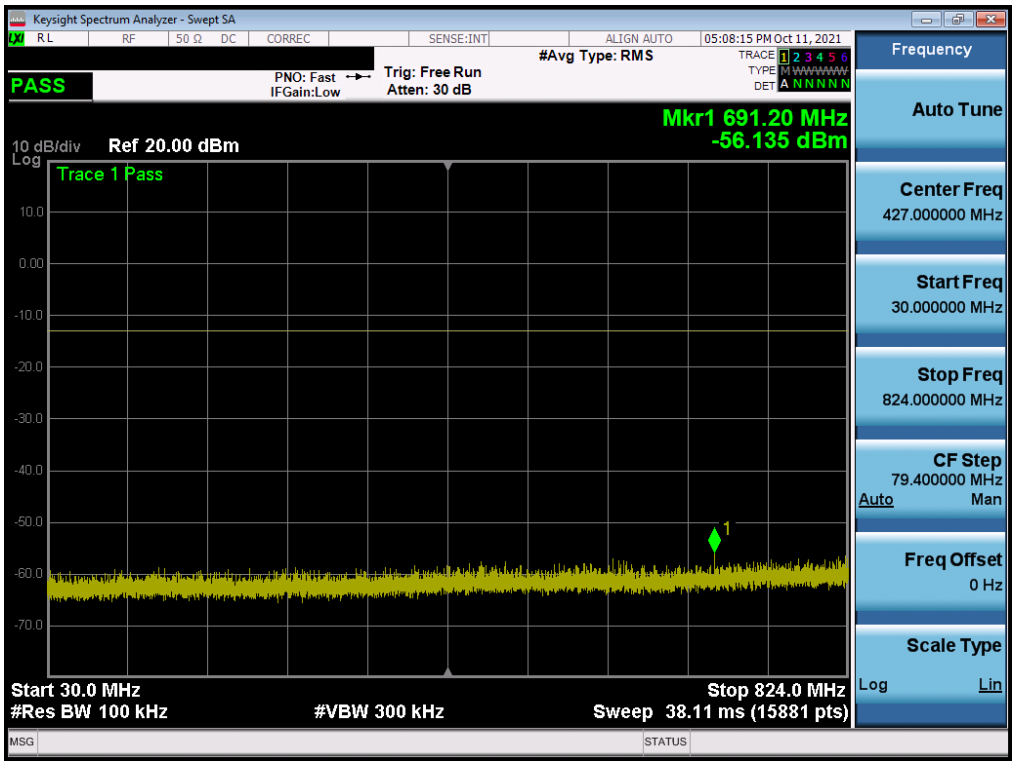
Plot 7-47. Conducted Spurious Plot (GPRS Ch. 190)



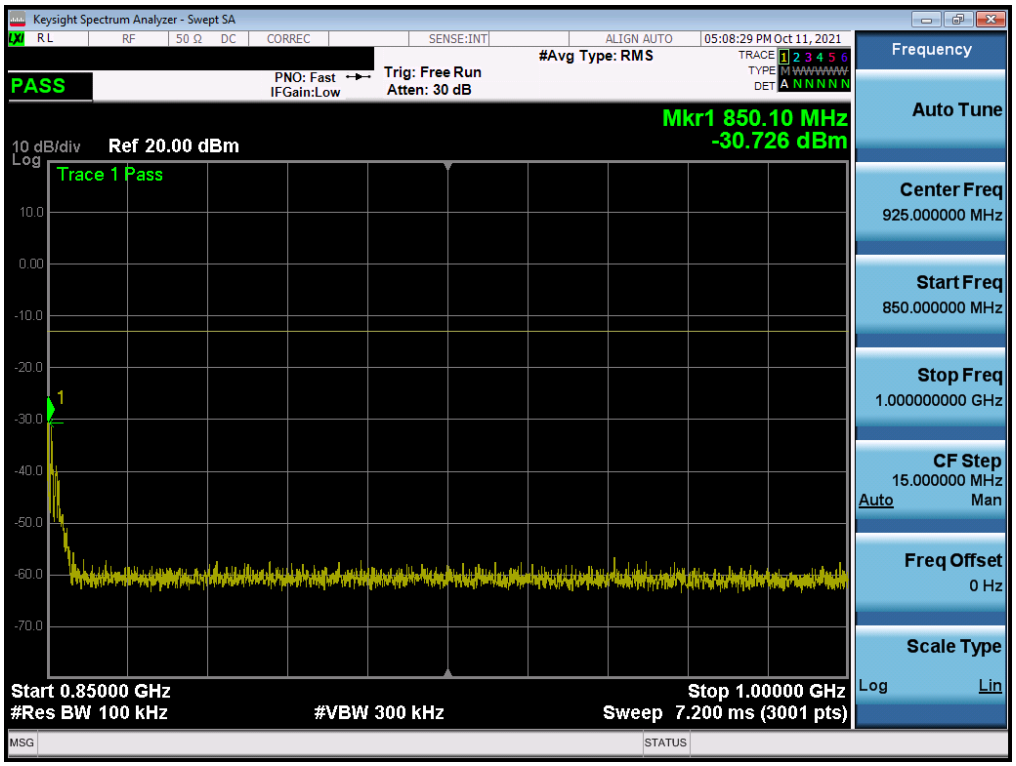
Plot 7-48. Conducted Spurious Plot (GPRS Ch. 190)



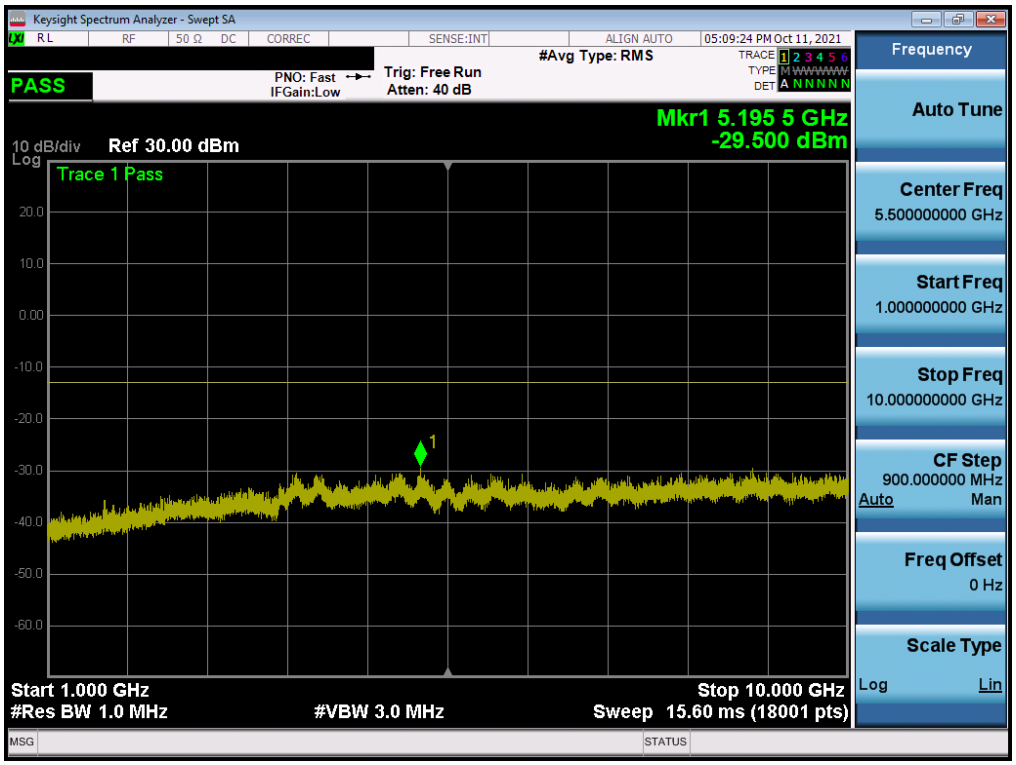
Plot 7-49. Conducted Spurious Plot (GPRS Ch. 190)



Plot 7-50. Conducted Spurious Plot (GPRS Ch. 251)

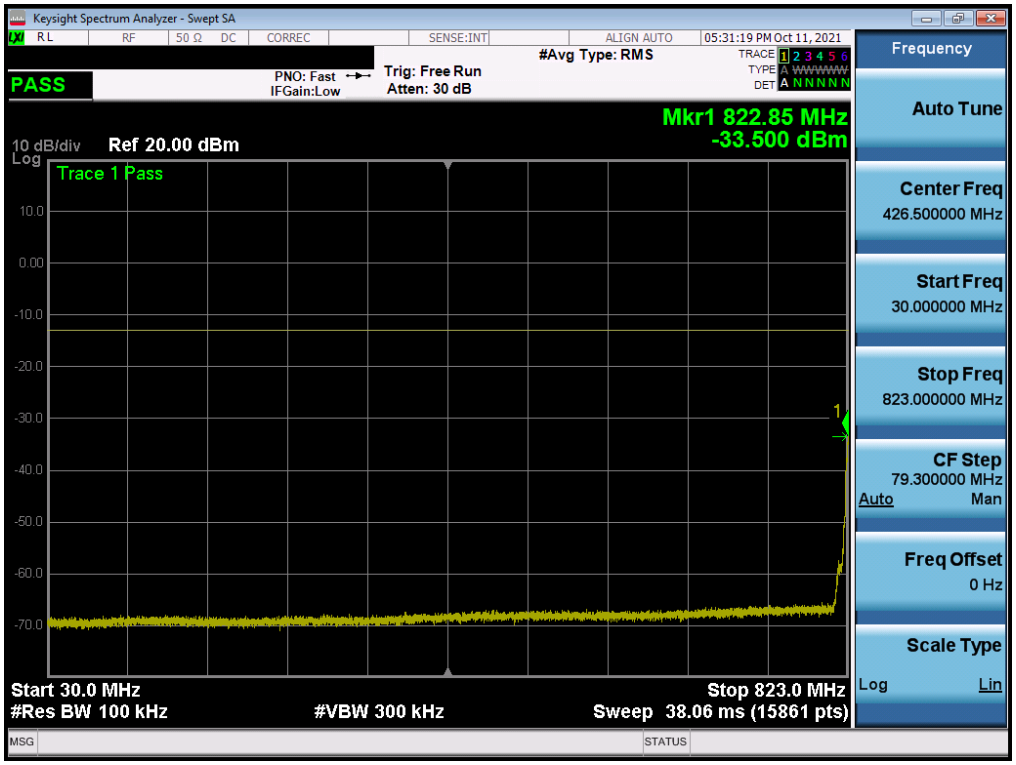


Plot 7-51. Conducted Spurious Plot (GPRS Ch. 251)

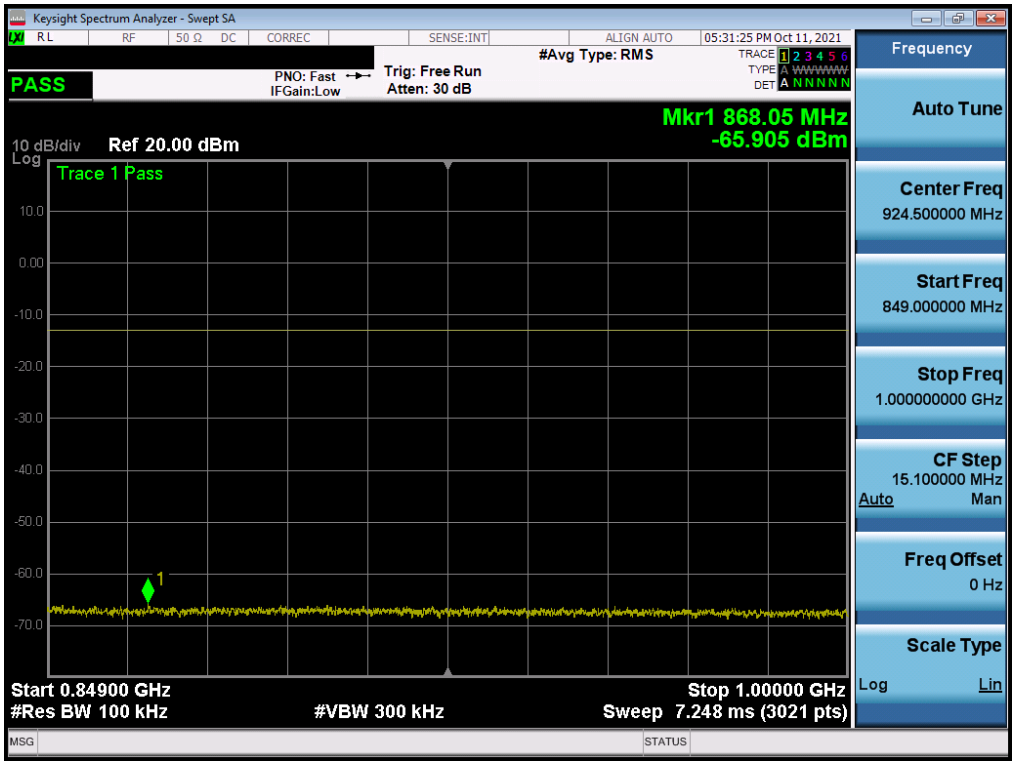


Plot 7-52. Conducted Spurious Plot (GPRS Ch. 251)

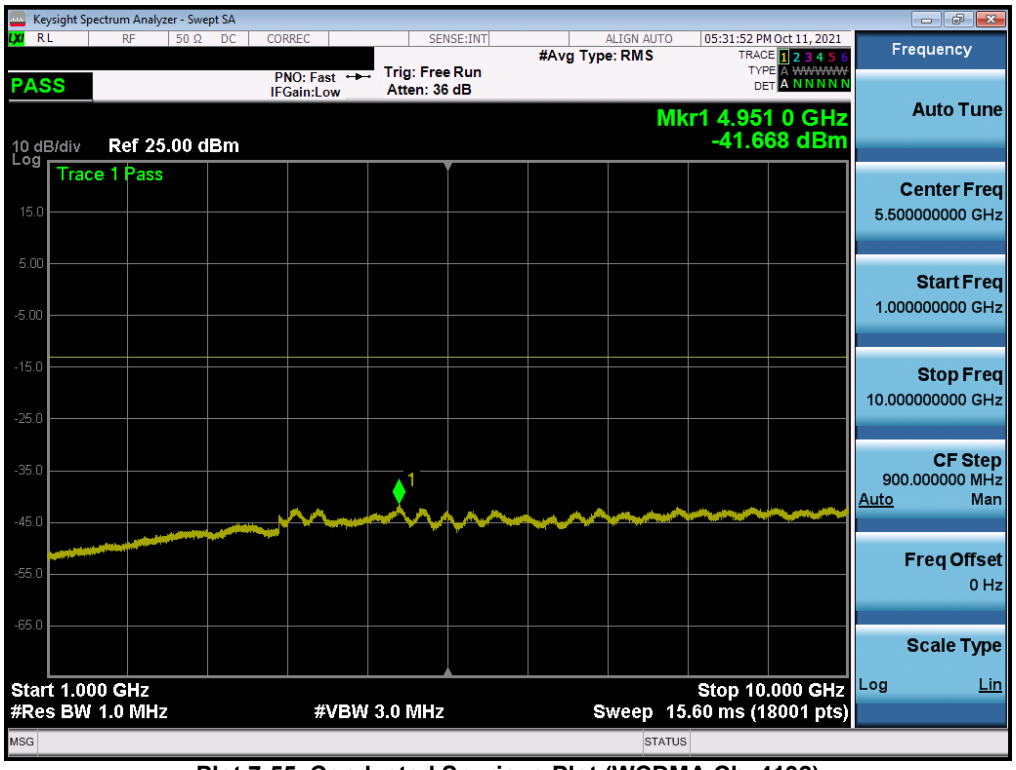
WCDMA Cell



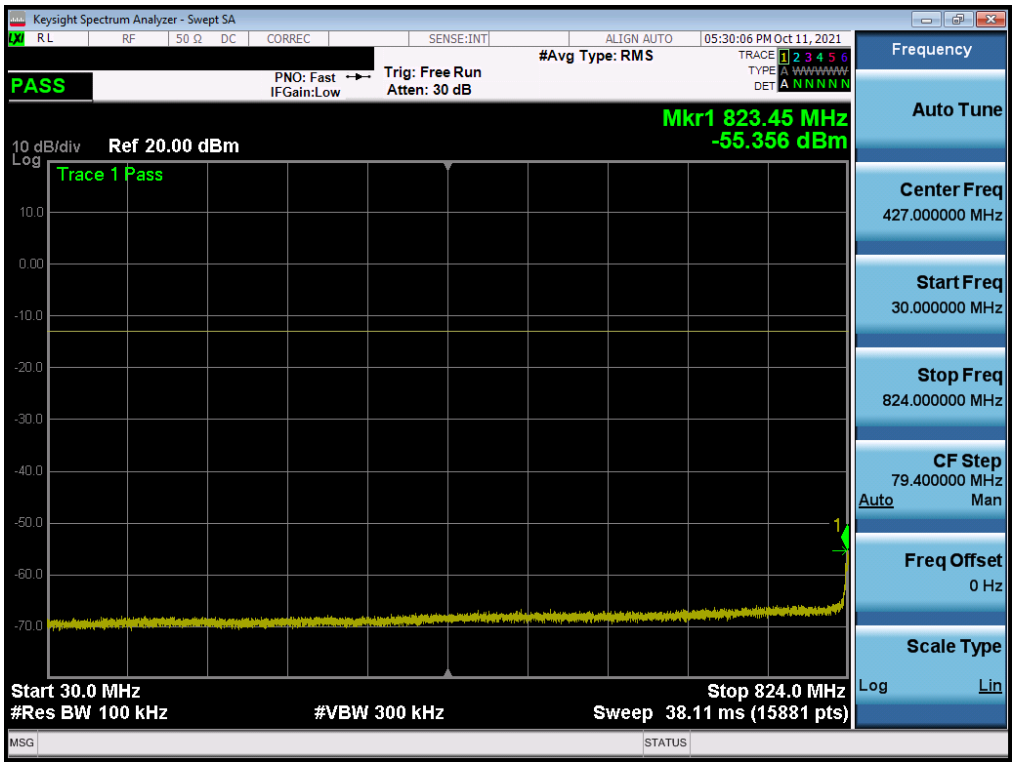
Plot 7-53. Conducted Spurious Plot (WCDMA Ch. 4132)



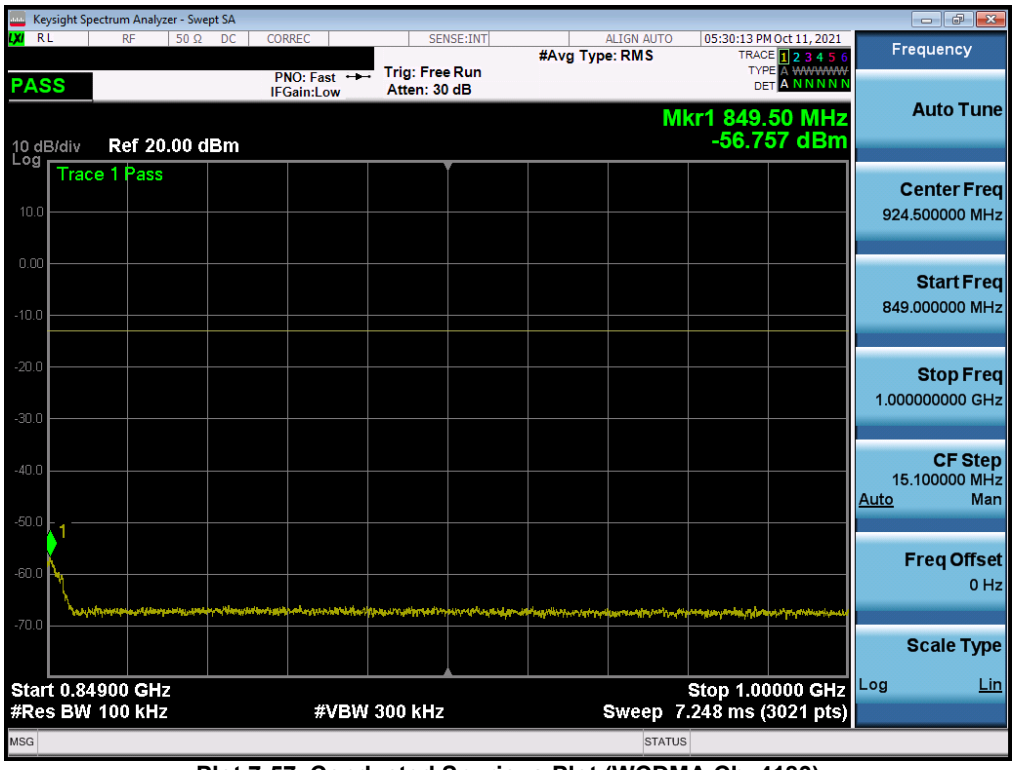
Plot 7-54. Conducted Spurious Plot (WCDMA Ch. 4132)



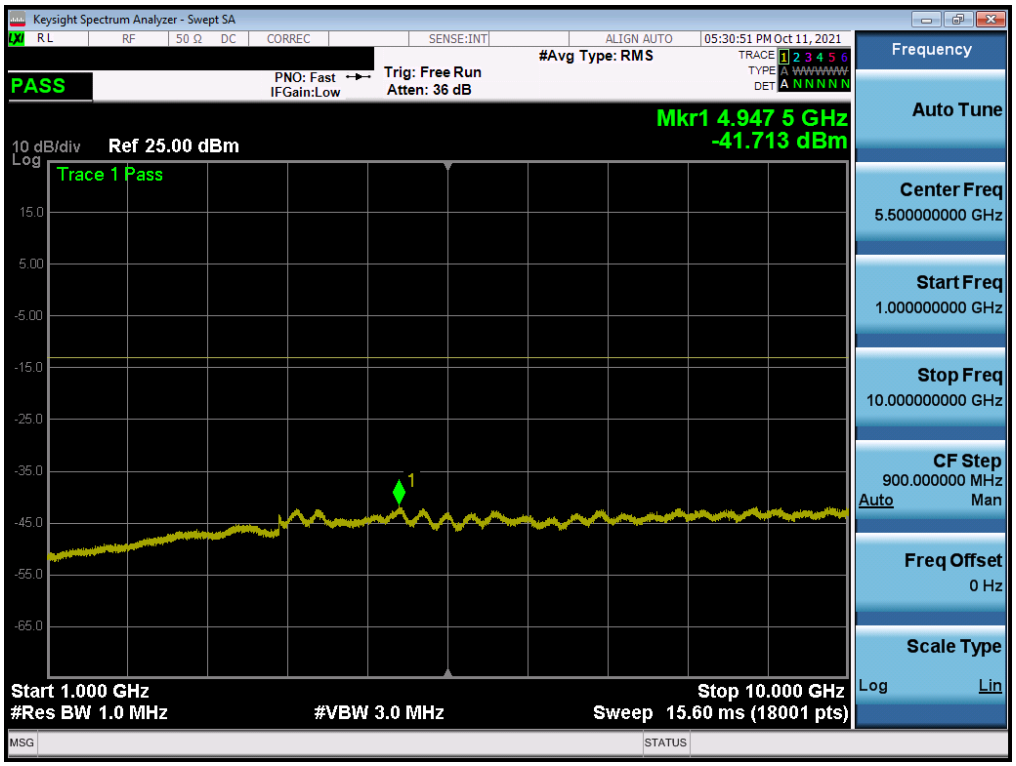
Plot 7-55. Conducted Spurious Plot (WCDMA Ch. 4132)



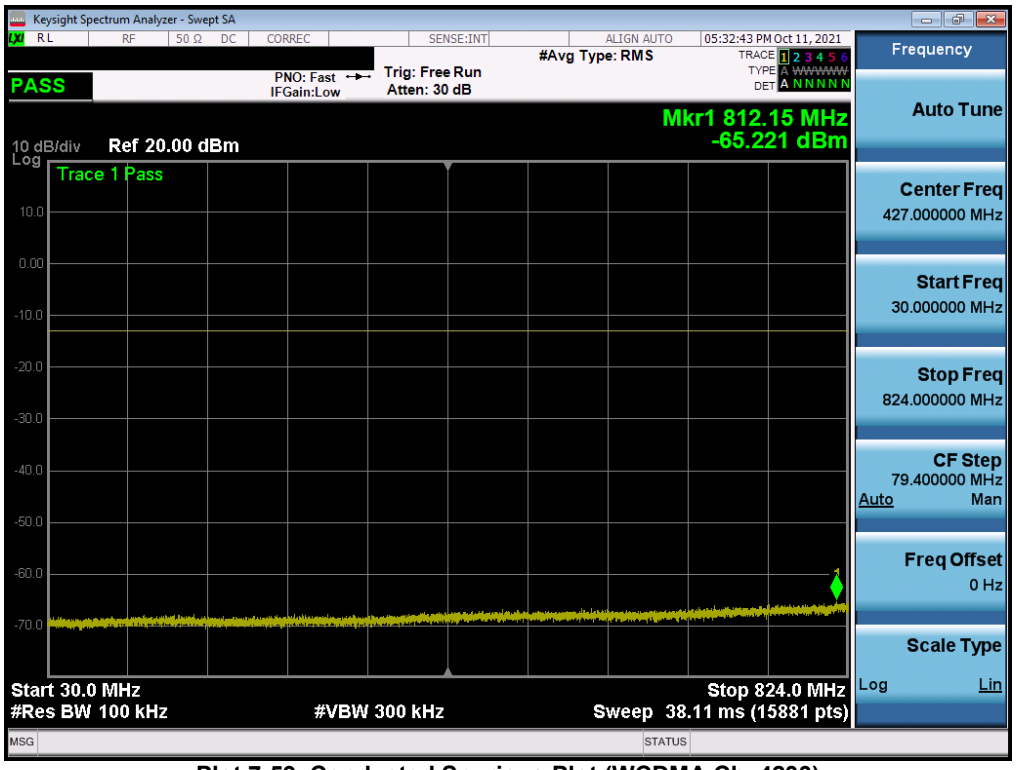
Plot 7-56. Conducted Spurious Plot (WCDMA Ch. 4183)



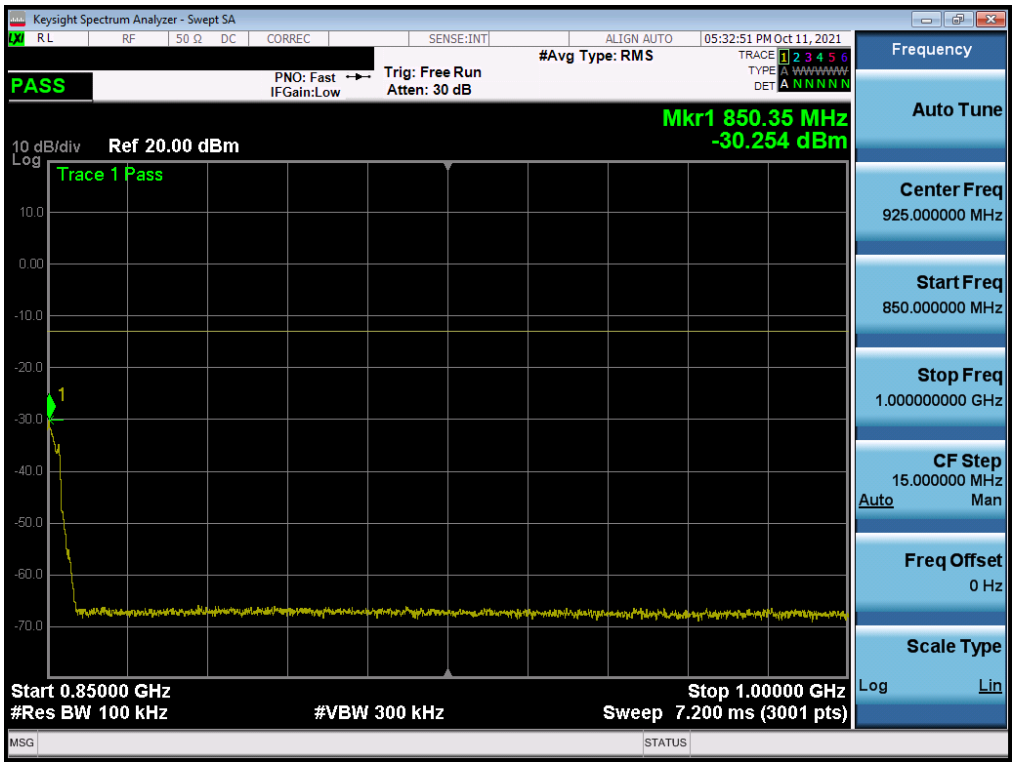
Plot 7-57. Conducted Spurious Plot (WCDMA Ch. 4183)



Plot 7-58. Conducted Spurious Plot (WCDMA Ch. 4183)



Plot 7-59. Conducted Spurious Plot (WCDMA Ch. 4233)



Plot 7-60. Conducted Spurious Plot (WCDMA Ch. 4233)

Plot 7-61. Conducted Spurious Plot (WCDMA Ch. 4233)

7.4 Band Edge Emissions at Antenna Terminal

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is 43 + 10 $log_{10}(P_{[Watts]})$, where P is the transmitter power in Watts.

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW ≥ 1% of the emission bandwidth
4. VBW ≥ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

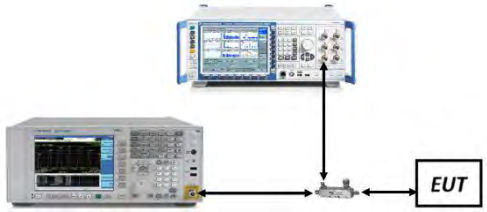
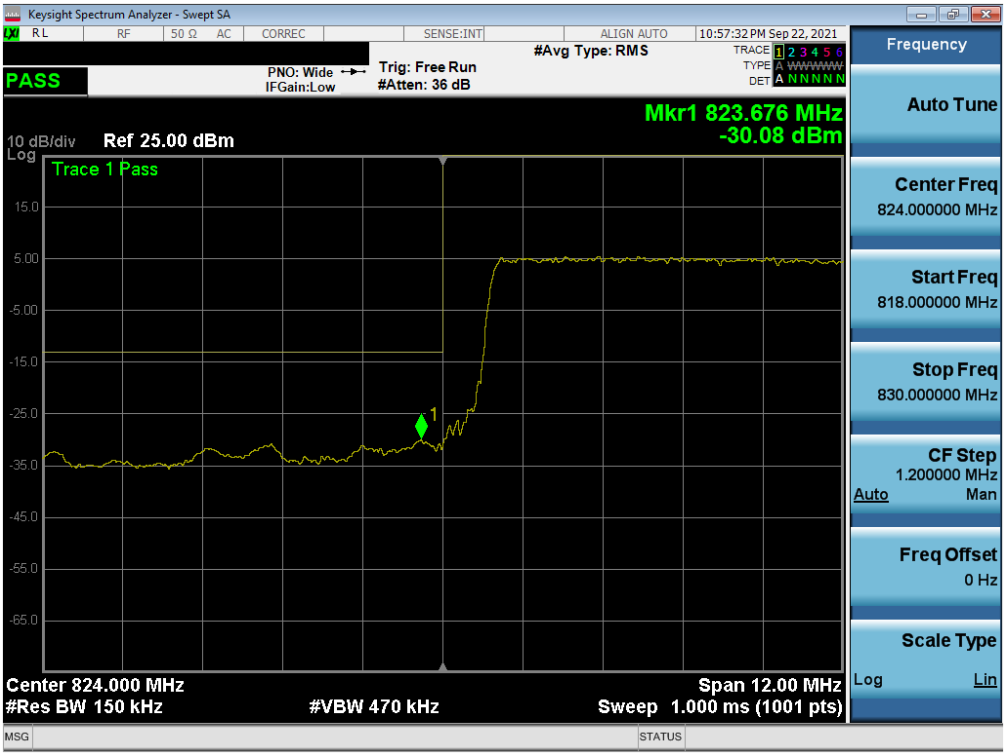


Figure 7-3. Test Instrument & Measurement Setup

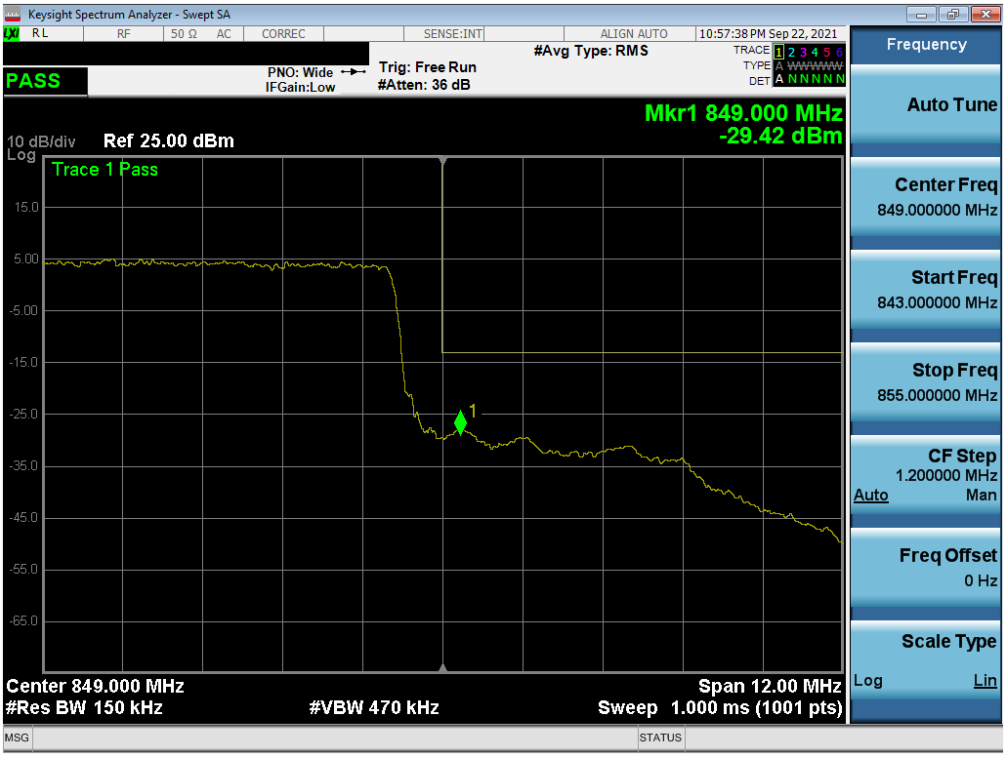
Test Notes

1. Per 22.917(b) and RSS-132(5.5), in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to demonstrate compliance with the out-of-band emissions limit. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

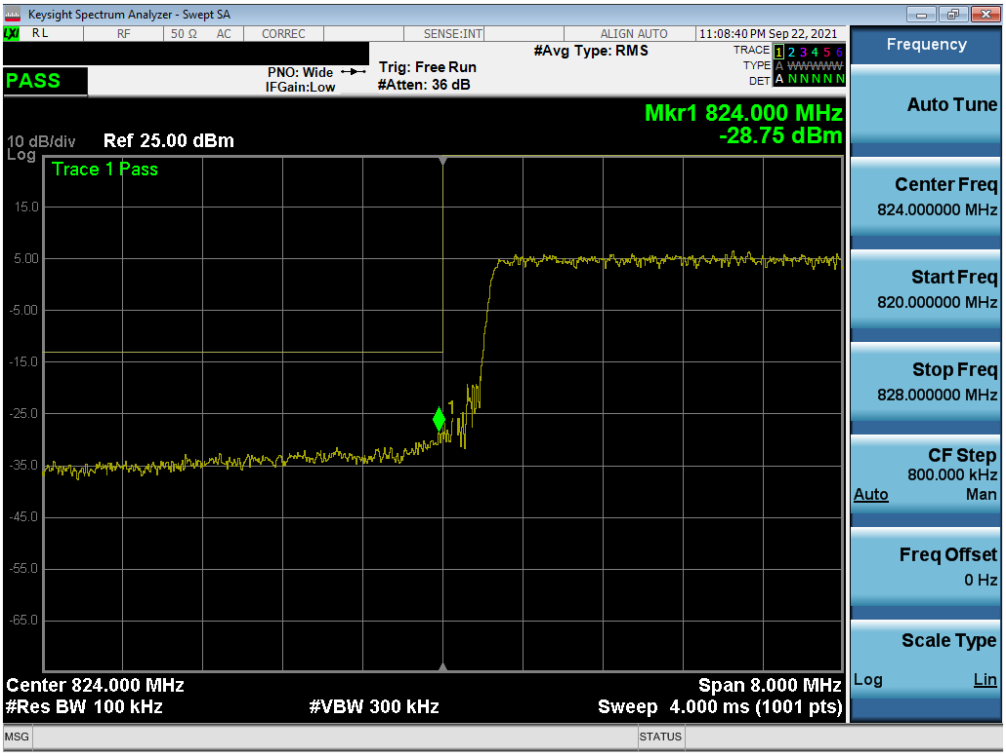
2. For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.



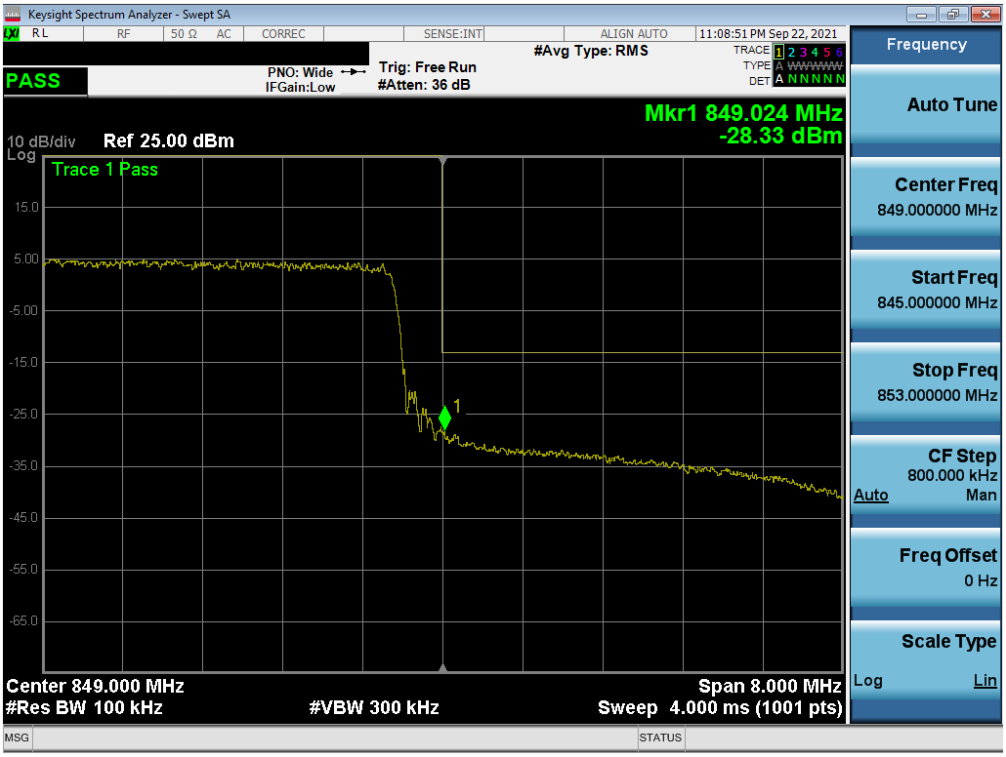
Plot 7-62. Lower Band Edge Plot (LTE Band 26 - 15MHz QPSK – Full RB)



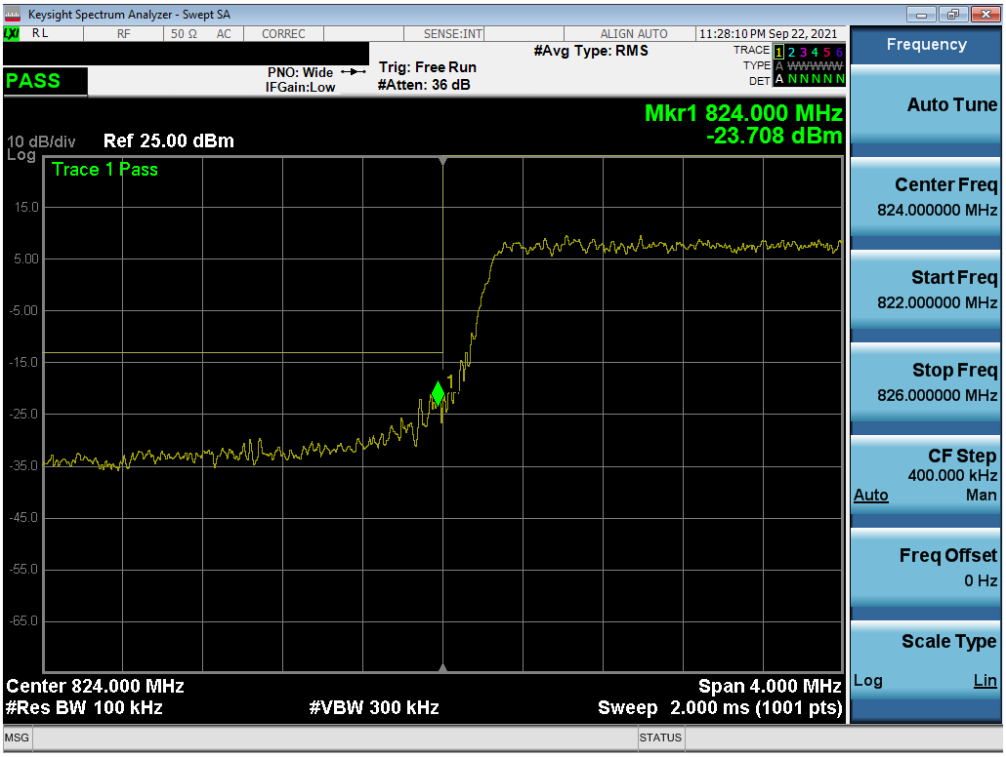
Plot 7-63. Upper Band Edge Plot (LTE Band 26 - 15MHz QPSK – Full RB)



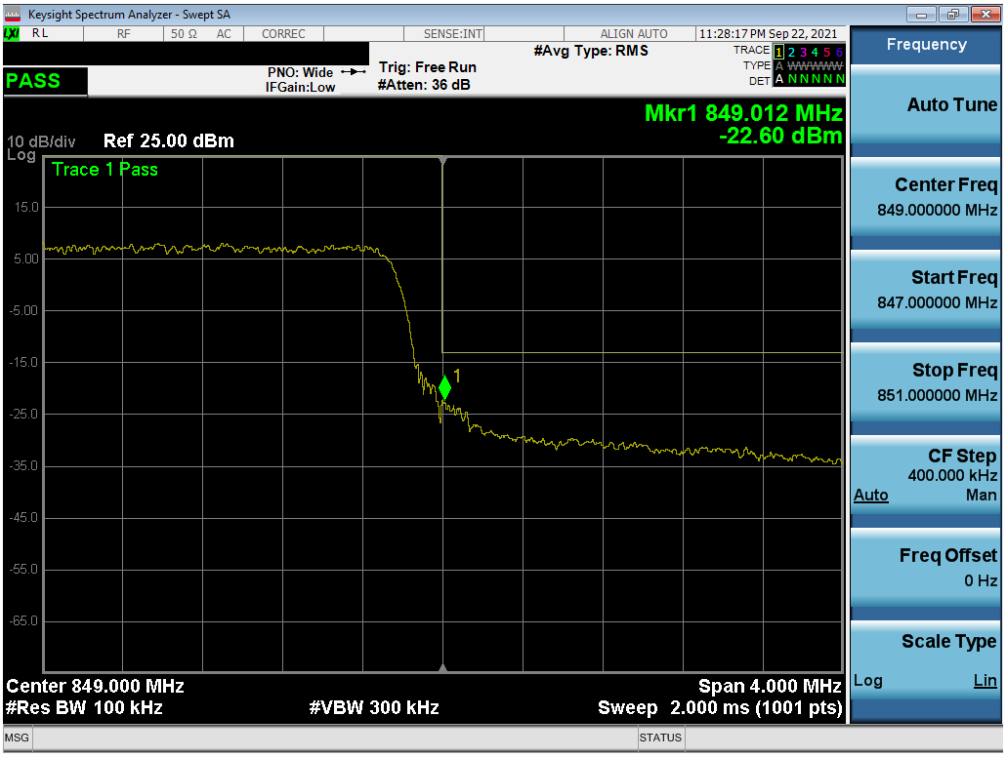
Plot 7-64. Lower Band Edge Plot (LTE Band 26/5 - 10MHz QPSK – Full RB)



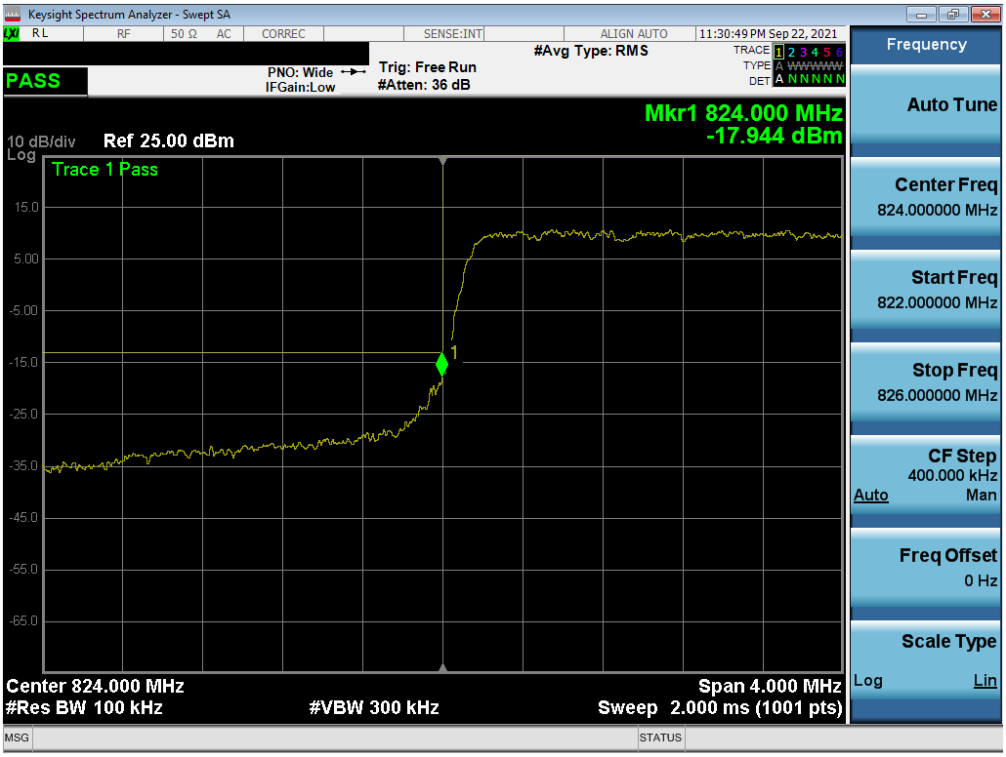
Plot 7-65. Upper Band Edge Plot (LTE Band 26/5 - 10MHz QPSK – Full RB)



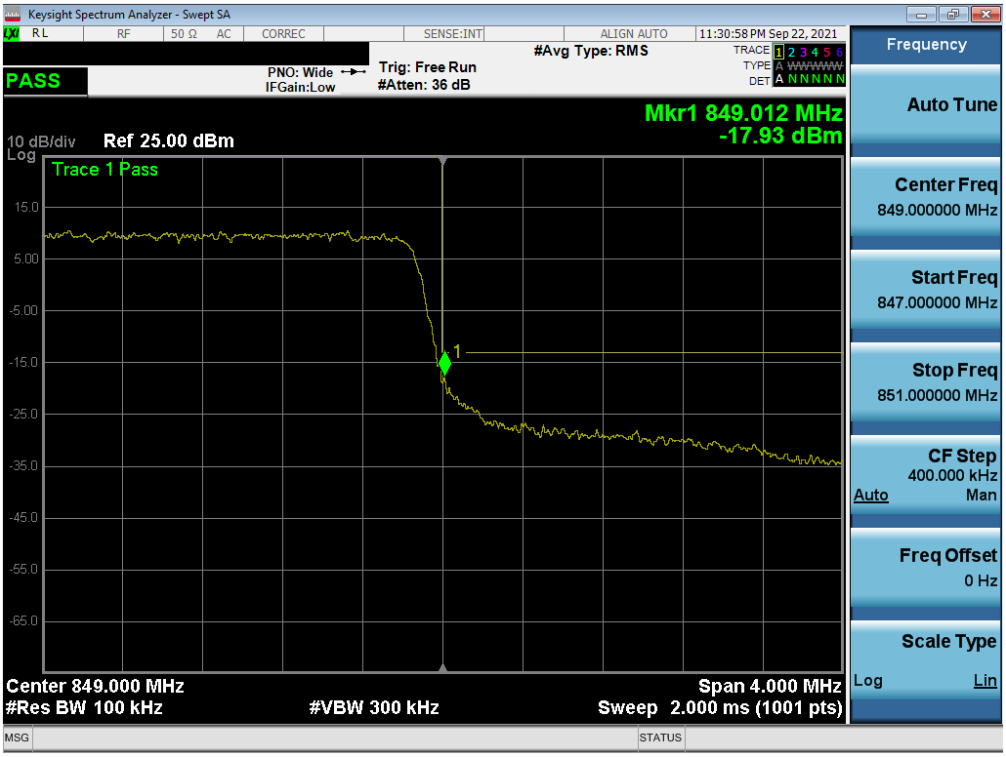
Plot 7-66. Lower Band Edge Plot (LTE Band 26/5 - 5MHz QPSK – Full RB)



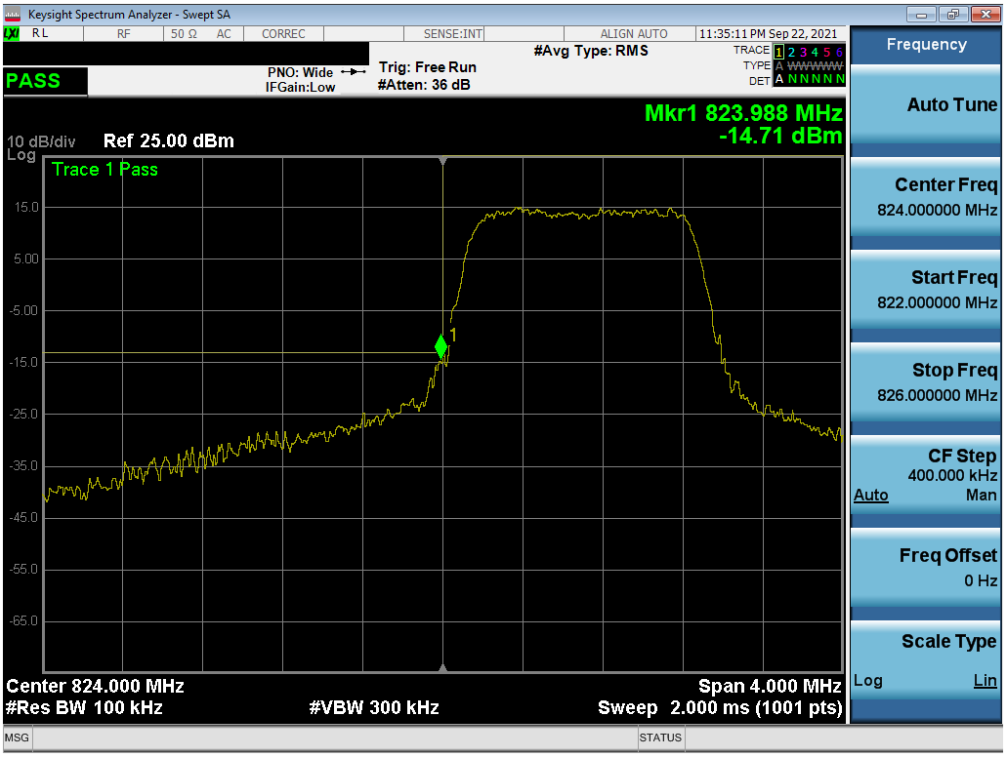
Plot 7-67. Upper Band Edge Plot (LTE Band 26/5 - 5MHz QPSK – Full RB)



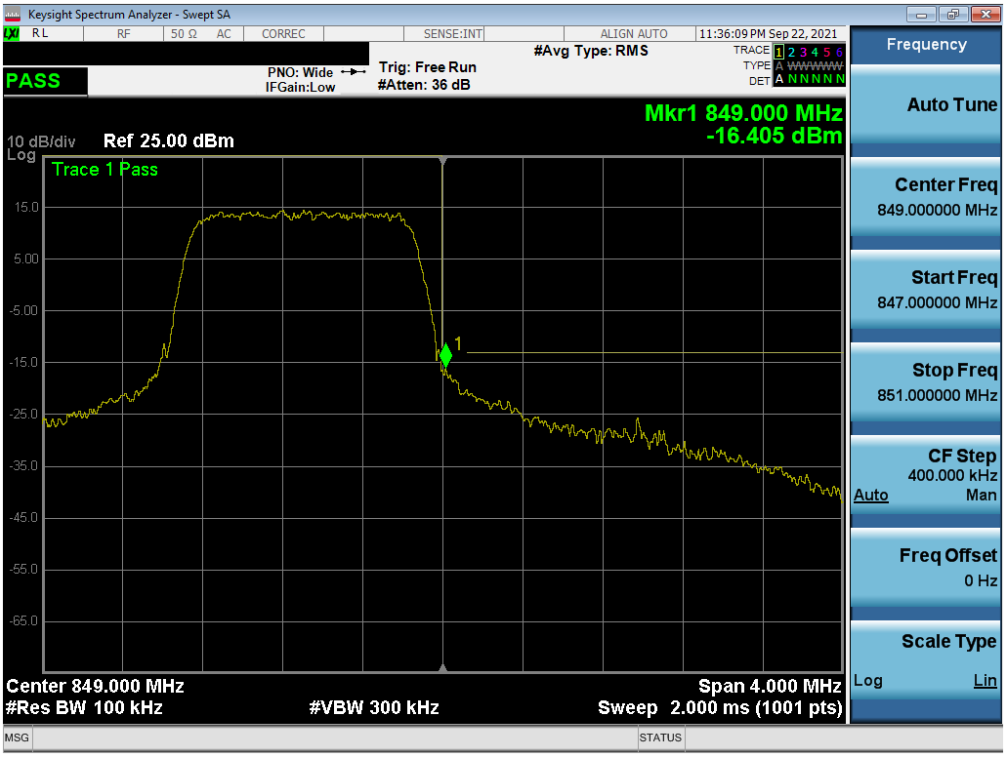
Plot 7-68. Lower Band Edge Plot (LTE Band 26/5 - 3MHz QPSK – Full RB)



Plot 7-69. Upper Band Edge Plot (LTE Band 26/5 - 3MHz QPSK – Full RB)



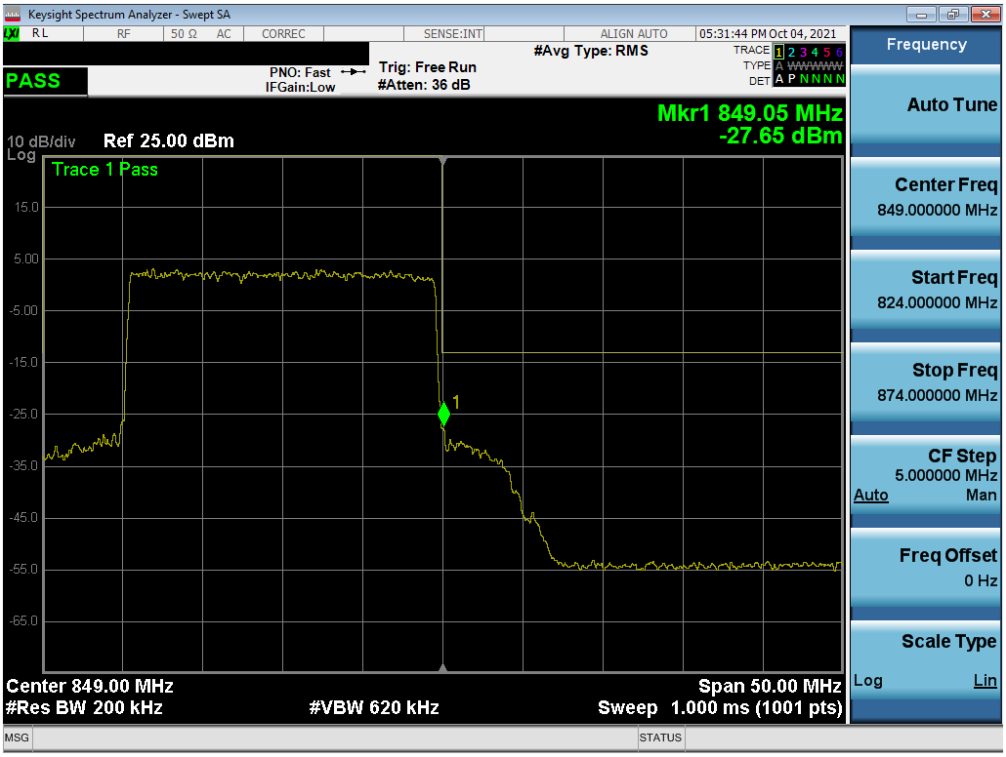
Plot 7-70. Lower Band Edge Plot (LTE Band 26/5 – 1.4MHz QPSK – Full RB)



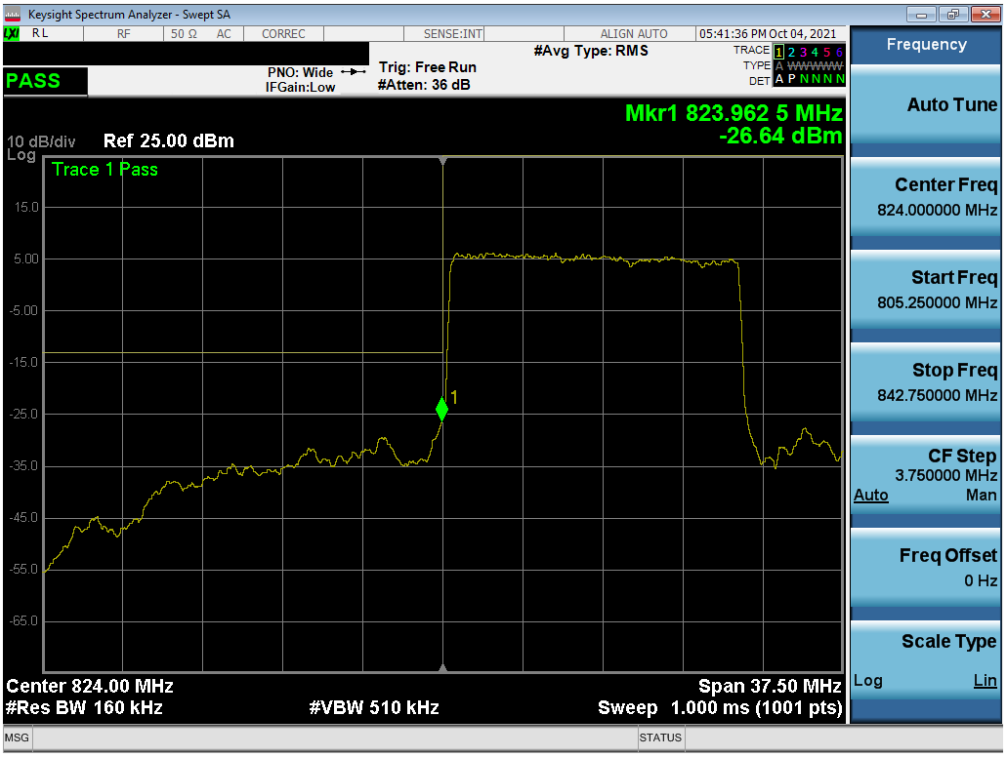
Plot 7-71. Upper Band Edge Plot (LTE Band 26/5 – 1.4MHz QPSK – Full RB)

NR Band n5

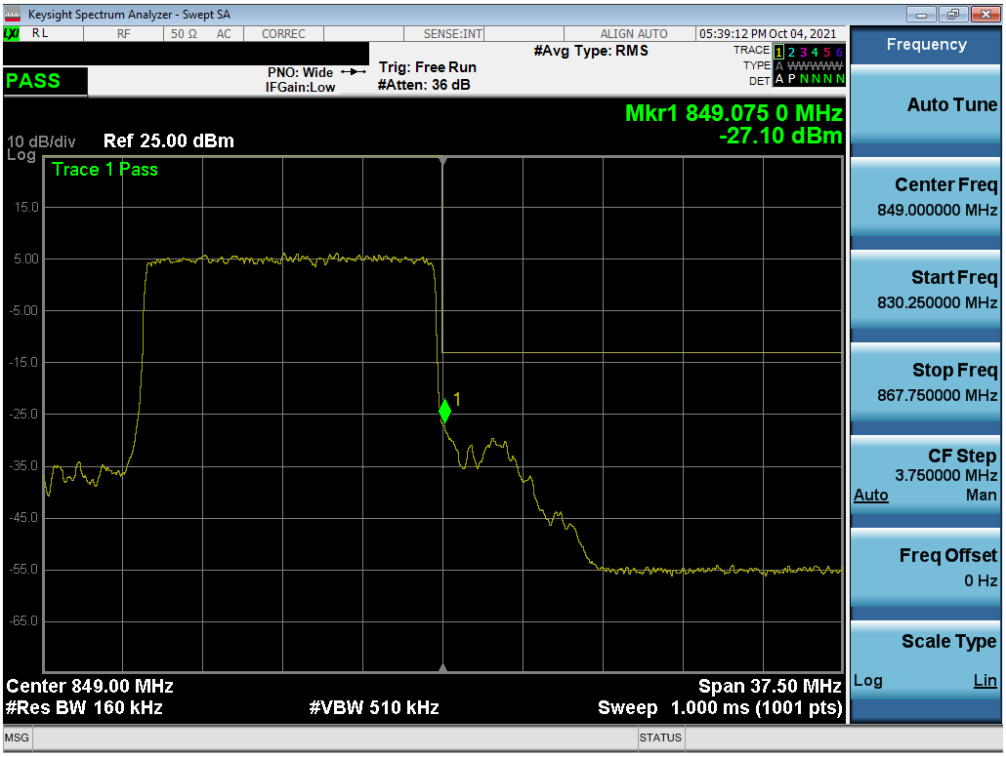
Plot 7-72. Lower Band Edge Plot (NR Band n5 – 20.0MHz - Full RB)



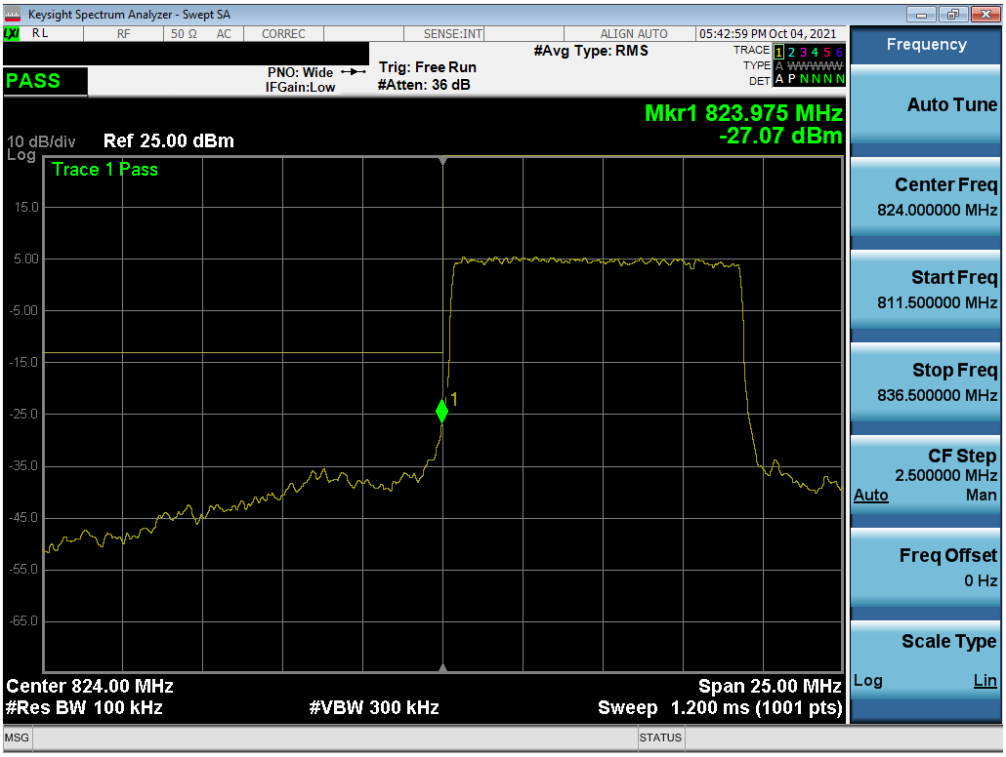
Plot 7-73. Upper Band Edge Plot (NR Band n5 – 20.0MHz - Full RB)



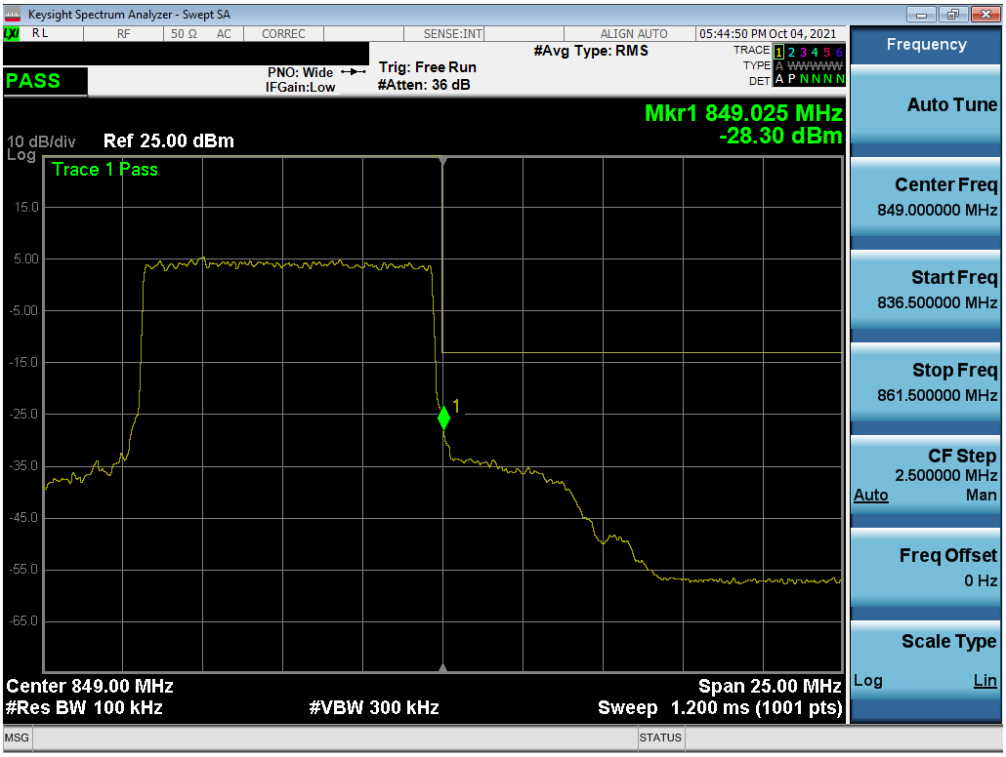
Plot 7-74. Lower Band Edge Plot (NR Band n5 – 15.0MHz - Full RB)



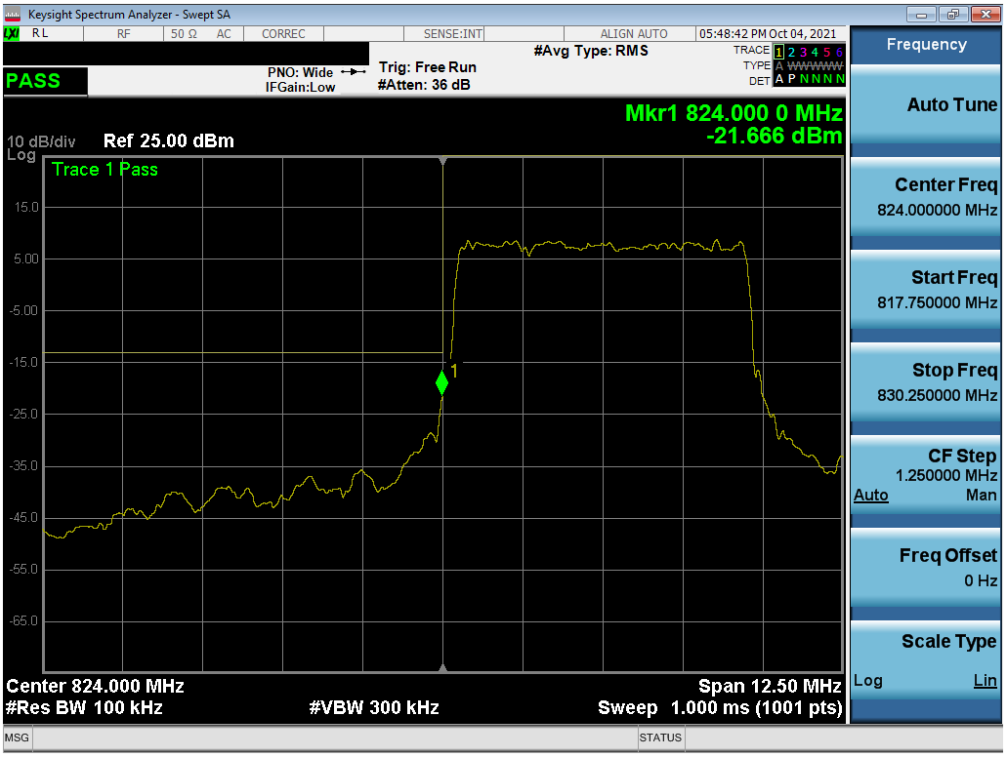
Plot 7-75. Upper Band Edge Plot (NR Band n5 – 15.0MHz - Full RB)



Plot 7-76. Lower Band Edge Plot (NR Band n5 – 10.0MHz - Full RB)

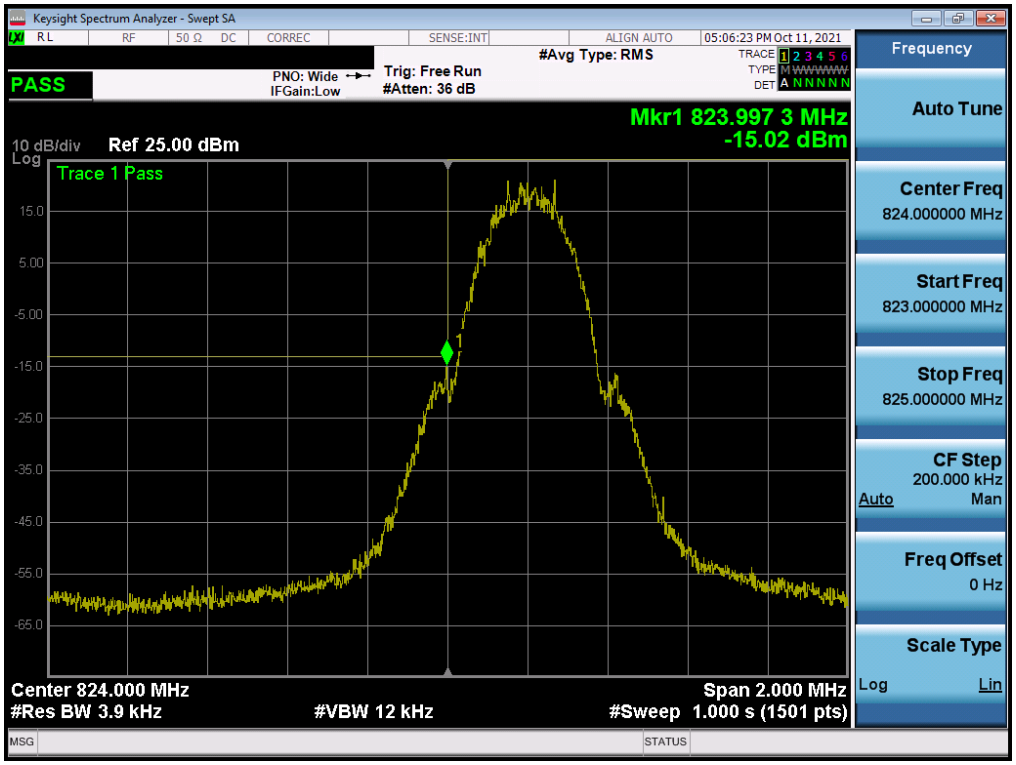


Plot 7-77. Upper Band Edge Plot (NR Band n5 – 10.0MHz - Full RB)

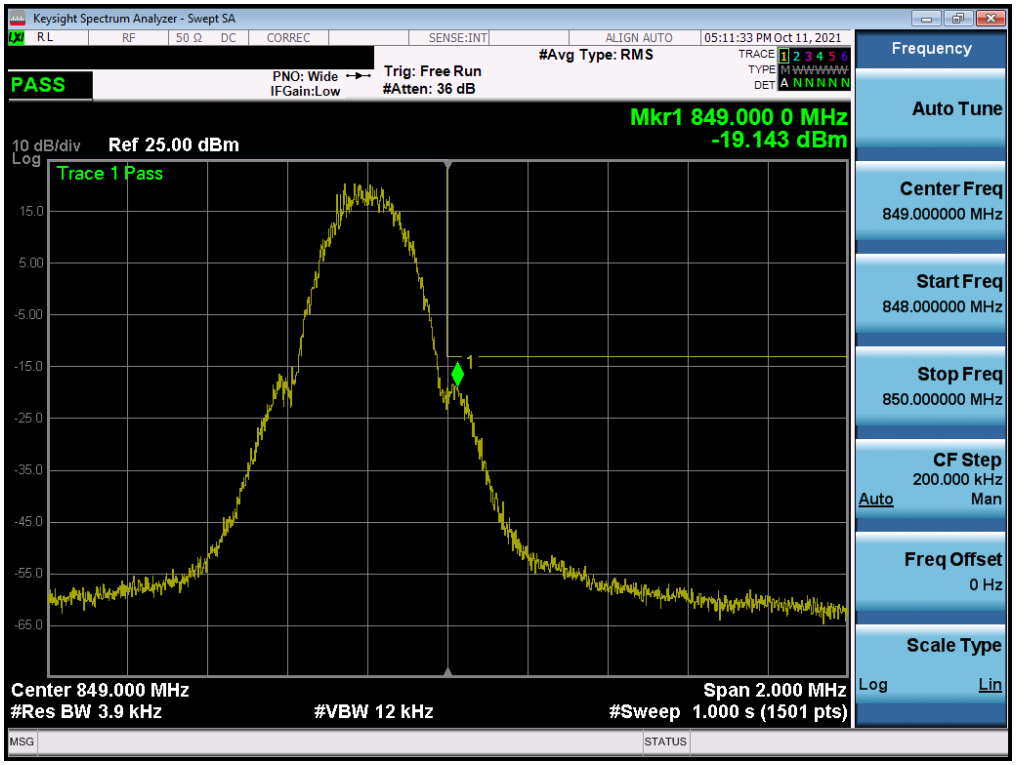


Plot 7-78. Lower Band Edge Plot (NR Band n5 – 5.0MHz - Full RB)

Plot 7-79. Upper Band Edge Plot (NR Band n5 – 5.0MHz - Full RB)



Plot 7-80. Lower Band Edge Plot (GPRS Cell – Ch. 128)



Plot 7-81. Upper Band Edge Plot (GPRS Cell – Ch. 251)

WCDMA Cell

Plot 7-82. Lower Band Edge Plot (WCDMA Cell – Ch. 4132)

Plot 7-83. Upper Band Edge Plot (WCDMA Cell – Ch. 4233)

7.5 Radiated Power (ERP)

Test Overview

Effective Radiated Power (ERP) measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as RMS average measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.2.1

ANSI/TIA-603-E-2016 – Section 2.2.17

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation. For signals with burst transmission, the signal analyzer's "time domain power" measurement capability is used
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW ≥ 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points ≥ 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto". Trigger is set to enable triggering only on full power bursts with the sweep time set less than or equal to the transmission burst duration
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation. For signals with burst transmission, the "gating" function was enabled to ensure that measurements are performed during times in which the transmitter is operating at its maximum power
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

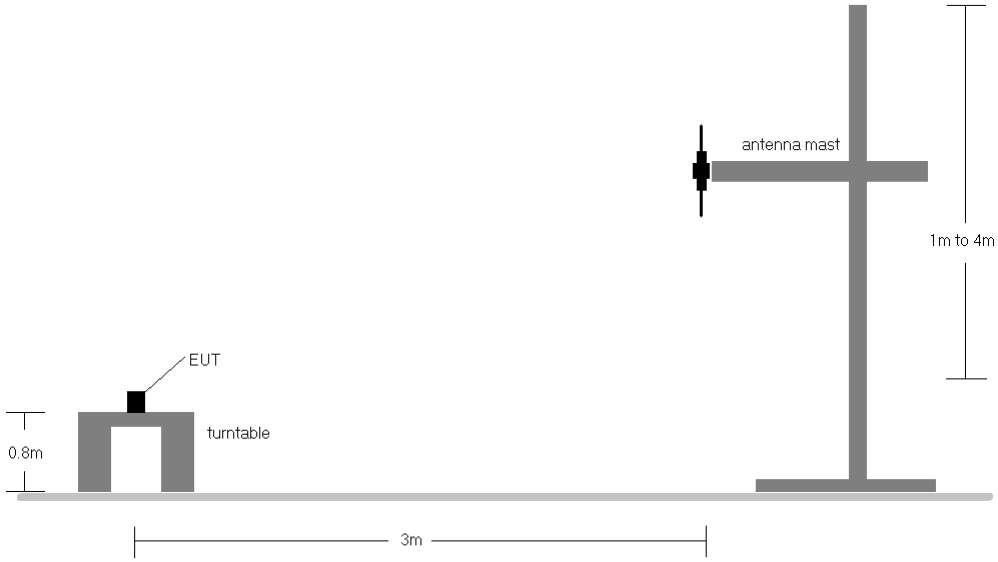


Figure 7-4. Radiated Test Setup <1GHz

Test Notes

1) This device employs GSM, GPRS, and EDGE capabilities. The EUT was tested under all configurations and the highest powers is reported in GPRS mode while transmitting with one slot active.

2) This device employs UMTS technology with WCDMA (AMR/RMC) and HSDPA capabilities. The EUT was tested under all configurations and the highest power is reported in WCDMA mode with HSDPA Inactive at 12.2 kbps RMC and TPC bits all set to “1”.

3) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

4) This unit was tested with its standard battery.

5) For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Bandwidth	Mod.	Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Ant. Gain [dBi]	RB Size/Offset	Substitute Level [dBm]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP [Watts]	EIRP Limit [dBm]	Margin [dB]
15MHz (Band 26 only)	QPSK	831.5	V	132	68	6.13	1 / 74	12.22	16.20	0.042	38.45	-22.25	18.35	0.068	40.61	-22.26
	QPSK	836.5	V	139	97	6.18	1 / 37	13.31	17.34	0.054	38.45	-21.11	19.49	0.089	40.61	-21.12
	QPSK	841.5	V	139	77	6.33	1 / 37	13.51	**17.69**	0.059	38.45	-20.76	**19.84**	0.096	40.61	-20.77
	16-QAM	841.5	V	139	77	6.33	1 / 37	12.44	16.62	0.046	38.45	-21.83	18.77	0.075	40.61	-21.84
10 MHz	QPSK	829.0	V	132	68	6.10	1 / 25	12.45	16.40	0.044	38.45	-22.05	18.55	0.072	40.61	-22.06
	QPSK	836.5	V	139	97	6.18	1 / 25	13.42	17.45	0.056	38.45	-21.00	19.60	0.091	40.61	-21.01
	QPSK	844.0	V	139	77	6.36	1 / 25	13.60	**17.80**	0.060	38.45	-20.65	**19.95**	0.099	40.61	-20.65
	16-QAM	836.5	V	139	97	6.18	1 / 25	12.95	16.98	0.050	38.45	-21.47	19.13	0.082	40.61	-21.48
5 MHz	QPSK	826.5	V	132	68	6.07	1 / 12	12.60	16.52	0.045	38.45	-21.93	18.67	0.074	40.61	-21.93
	QPSK	836.5	V	139	97	6.18	1 / 12	13.51	17.54	0.057	38.45	-20.91	19.69	0.093	40.61	-20.92
	QPSK	846.5	V	139	77	6.38	1 / 12	13.55	**17.78**	0.060	38.45	-20.67	**19.93**	0.098	40.61	-20.68
	16-QAM	836.5	V	139	97	6.18	1 / 12	12.78	16.80	0.048	38.45	-21.65	18.95	0.079	40.61	-21.65
3 MHz	QPSK	825.5	V	132	68	6.06	1 / 7	12.44	16.36	0.043	38.45	-22.10	18.51	0.071	40.61	-22.10
	QPSK	836.5	V	139	97	6.18	1 / 7	13.53	17.56	0.057	38.45	-20.89	19.71	0.094	40.61	-20.89
	QPSK	847.5	V	139	77	6.39	1 / 7	13.61	**17.85**	0.061	38.45	-20.60	**20.00**	0.100	40.61	-20.61
	16-QAM	836.5	V	139	97	6.18	1 / 7	13.03	17.06	0.051	38.45	-21.40	19.21	0.083	40.61	-21.40
1.4 MHz	QPSK	824.7	V	132	68	6.09	1 / 3	12.47	16.40	0.044	38.45	-22.05	18.55	0.072	40.61	-22.05
	QPSK	836.5	V	139	97	6.18	1 / 3	13.42	17.45	0.056	38.45	-21.00	19.60	0.091	40.61	-21.01
	QPSK	848.3	V	139	77	6.40	1 / 3	13.50	**17.75**	0.060	38.45	-20.70	**19.90**	0.098	40.61	-20.70
	16-QAM	836.5	V	139	97	6.18	1 / 3	12.85	16.87	0.049	38.45	-21.58	19.02	0.080	40.61	-21.58
15MHz	QPSK (Opposite Pol.)	841.5	H	207	61	6.73	1 / 37	11.37	15.95	0.039	38.45	-22.50	18.10	0.065	40.61	-22.51
	QPSK (WCP)	841.5	V	139	244	6.33	1 / 0	10.22	14.40	0.028	38.45	-24.05	16.55	0.045	40.61	-24.06

Table 7-2. ERP Data (LTE Band 26/5)

Bandwidth	Mod.	Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Ant. Gain [dBi]	RB Size/Offset	Substitute Level [dBm]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP [Watts]	EIRP Limit [dBm]	Margin [dB]
20 MHz	π/2 BPSK	834.0	V	139	130	6.15	1 / 53	15.13	19.13	0.082	38.45	-19.32	21.28	0.134	40.61	-19.32
	π/2 BPSK	836.5	V	152	117	6.18	1 / 79	15.34	19.37	0.086	38.45	-19.08	21.52	0.142	40.61	-19.09
	π/2 BPSK	839.0	V	151	120	6.30	1 / 79	15.34	**19.49**	0.089	38.45	-18.96	**21.64**	0.146	40.61	-18.96
	QPSK	836.5	V	152	117	6.18	1 / 79	15.46	19.49	0.089	38.45	-18.96	21.64	0.146	40.61	-18.97
	16-QAM	836.5	V	152	117	6.18	1 / 79	14.50	18.53	0.071	38.45	-19.92	20.68	0.117	40.61	-19.93
15 MHz	π/2 BPSK	831.5	V	139	130	6.13	1 / 20	15.29	19.26	0.084	38.45	-19.19	21.41	0.138	40.61	-19.19
	π/2 BPSK	836.5	V	152	117	6.18	1 / 20	15.28	19.31	0.085	38.45	-19.14	21.46	0.140	40.61	-19.15
	π/2 BPSK	841.5	V	151	120	6.33	1 / 20	15.33	19.51	0.089	38.45	-18.94	21.66	0.147	40.61	-18.94
	QPSK	836.5	V	152	117	6.18	1 / 20	15.53	**19.56**	0.090	38.45	-18.89	**21.71**	0.148	40.61	-18.89
	16-QAM	836.5	V	152	117	6.18	1 / 20	14.31	18.34	0.068	38.45	-20.11	20.49	0.112	40.61	-20.12
10 MHz	π/2 BPSK	829.0	V	139	130	6.10	1 / 13	15.02	18.97	0.079	38.45	-19.48	21.12	0.130	40.61	-19.48
	π/2 BPSK	836.5	V	152	117	6.18	1 / 13	15.14	19.17	0.083	38.45	-19.28	21.32	0.135	40.61	-19.29
	π/2 BPSK	844.0	V	151	120	6.36	1 / 13	15.11	**19.31**	0.085	38.45	-19.14	**21.46**	0.140	40.61	-19.14
	QPSK	836.5	V	152	117	6.18	1 / 13	15.22	19.25	0.084	38.45	-19.20	21.40	0.138	40.61	-19.20
	16-QAM	836.5	V	152	117	6.18	1 / 13	14.03	18.06	0.064	38.45	-20.39	20.21	0.105	40.61	-20.40
5 MHz	π/2 BPSK	829.0	V	139	130	6.07	1 / 6	15.06	18.99	0.079	38.45	-19.47	21.14	0.130	40.61	-19.47
	π/2 BPSK	836.5	V	152	117	6.18	1 / 12	15.15	19.17	0.083	38.45	-19.28	21.32	0.136	40.61	-19.28
	π/2 BPSK	844.0	V	151	120	6.38	1 / 18	14.86	19.09	0.081	38.45	-19.36	21.24	0.133	40.61	-19.36
	QPSK	836.5	V	152	117	6.18	1 / 12	15.35	**19.38**	0.087	38.45	-19.07	**21.53**	0.142	40.61	-19.07
	16-QAM	836.5	V	152	117	6.18	1 / 12	14.17	18.20	0.066	38.45	-20.25	20.35	0.108	40.61	-20.26
20 MHz	QPSK (CP-OFDM)	839.0	V	151	120	6.30	1 / 53	14.10	**18.25**	0.067	38.45	-20.20	20.40	0.110	40.61	-20.20
	QPSK (Opposite Pol.)	839.0	H	100	76	6.80	1 / 26	12.80	17.45	0.056	38.45	-21.00	19.60	0.091	40.61	-21.00
	QPSK (WCP)	839.0	V	187	279	6.30	1 / 79	9.02	13.17	0.021	38.45	-25.28	15.32	0.034	40.61	-25.28

Table 7-3. ERP Data (NR Band n5)

Frequency [MHz]	Mode	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Substitute Level [dBm]	Ant. Gain [dBi]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP [Watts]	EIRP Limit [dBm]	Margin [dB]
824.20	GPRS850	V	134	94	20.10	6.13	24.08	0.256	38.45	-14.37	26.23	0.420	40.61	-14.38
836.60	GPRS850	V	142	113	20.99	6.18	**25.02**	**0.318**	38.45	-13.43	**27.17**	**0.521**	40.61	-13.44
848.80	GPRS850	V	150	115	20.21	6.41	24.47	0.280	38.45	-13.99	26.62	0.459	40.61	-13.99
836.60	GPRS850	H	202	70	19.72	6.18	23.75	0.237	38.45	-14.70	25.90	0.389	40.61	-14.71
836.60	EDGE850	V	142	113	15.96	6.18	**19.99**	0.100	38.45	-18.46	**22.14**	**0.164**	40.61	-18.47
836.60	GPRS850 (WCP)	V	142	79	16.24	6.18	20.27	0.106	38.45	-18.18	22.42	0.175	40.61	-18.19

Table 7-4. ERP Data (GPRS Cell)

Frequency [MHz]	Mode	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Substitute Level [dBm]	Ant. Gain [dBi]	ERP [dBm]	ERP [Watts]	ERP Limit [dBm]	Margin [dB]	EIRP [dBm]	EIRP [Watts]	EIRP Limit [dBm]	Margin [dB]
826.40	WCDMA850	V	133	95	13.75	6.07	17.67	0.059	38.45	-20.78	19.82	0.096	40.61	-20.78
836.60	WCDMA850	V	137	92	13.70	6.18	**17.73**	**0.059**	38.45	-20.72	**19.88**	**0.097**	40.61	-20.73
846.60	WCDMA850	V	136	87	13.29	6.38	17.52	0.057	38.45	-20.93	19.67	0.093	40.61	-20.93
836.60	WCDMA850	H	210	70	12.85	6.74	17.44	0.055	38.45	-21.01	19.59	0.091	40.61	-21.02
836.60	WCDMA850 (WCP)	V	144	102	8.32	6.18	12.35	0.017	38.45	-26.10	14.50	0.028	40.61	-26.11

Table 7-5. ERP Data (WCDMA Cell)

7.6 Uplink Carrier Aggregation

§22.917(a)

Test Overview

The EUT is set up to transmit two contiguous LTE channels. The power level of both carriers and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

For Band 5, the minimum permissible attenuation level of any spurious emission is 43 + 10 log10(P[Watts]).

Test Procedure Used

KDB 971168 D01 v03r01 – Section 6.0

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to at least 10 * the fundamental frequency (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-5. Test Instrument & Measurement Setup

Test Notes

1. Conducted power and spurious emissions measurements were evaluated for the two contiguous channels using various combinations of RB size, RB offset, modulation, and channel bandwidth. Channel bandwidth data is shown in the tables below based only on the channel bandwidths that were supported in this device. The worst case (highest) powers were found while operating with QPSK modulation with both carriers set to transmit using 1RB.

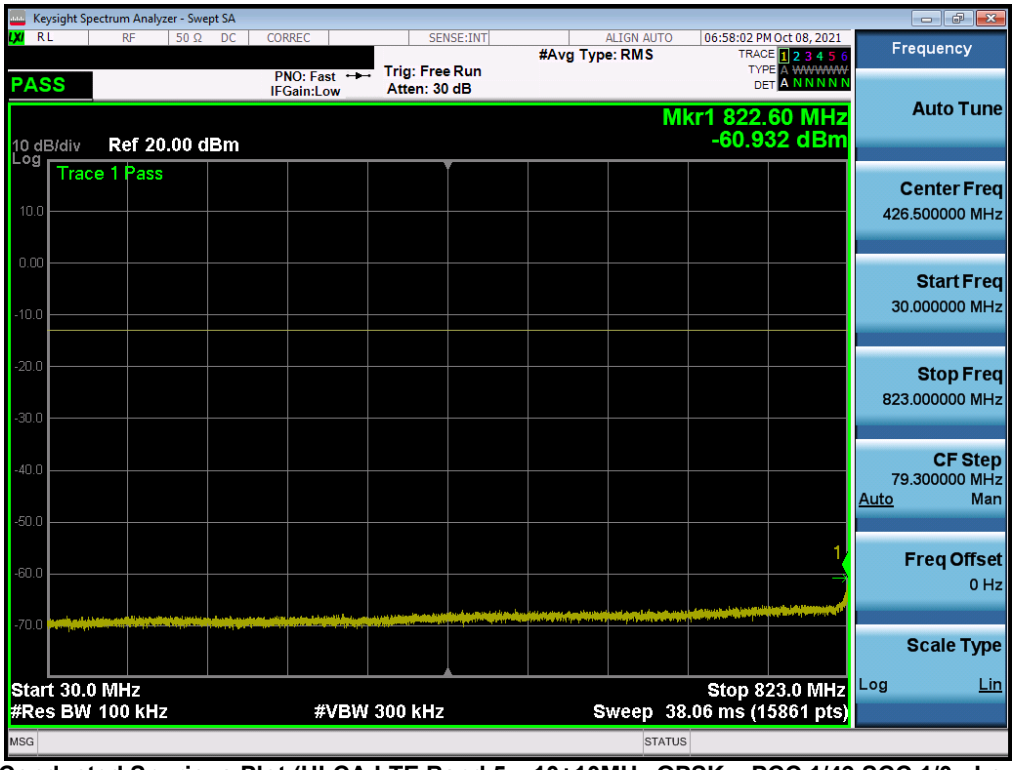
2. Conducted power measurements are also evaluated for simultaneous transmission of two NR FR1 carriers operating in different bands (interband NR FR1 ULCA). The powers were investigated while both bands are operating at their widest supported channel bandwidth

3. Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz and 1 MHz or greater for frequencies greater than 1 GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

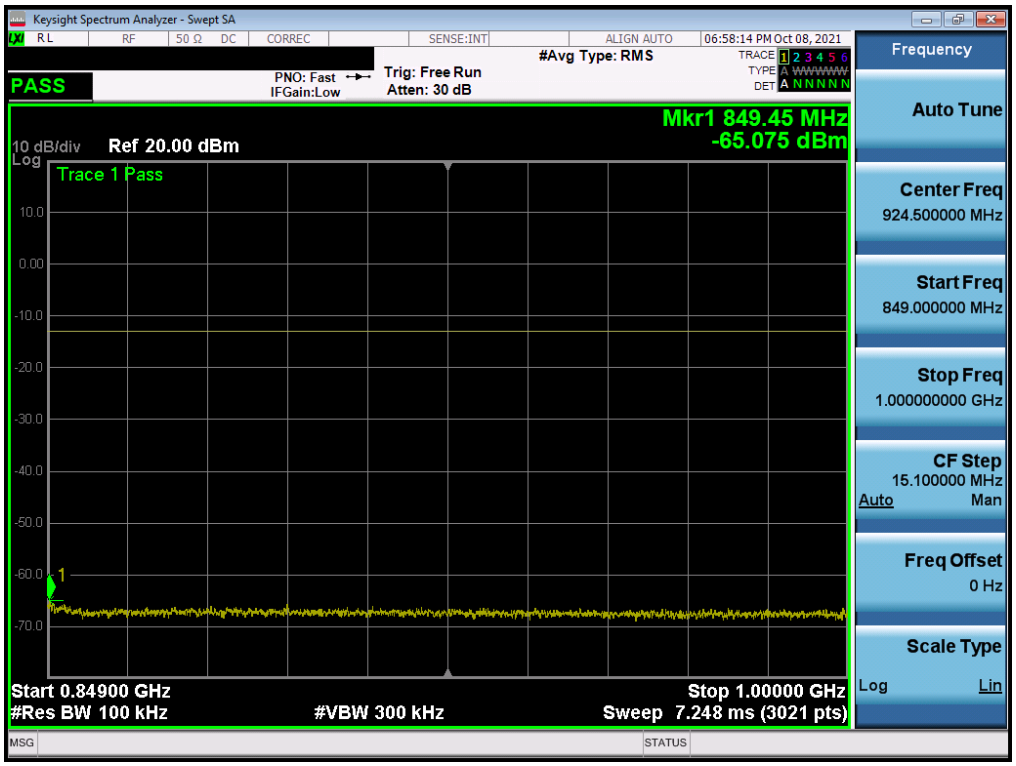
Uplink CA Configuration 5B

Power State	Band	Bandwidth (PCC + SCC)	PCC					SCC					ULCA Tx. Power [dBm]
			Modulation	UL Channel	UL Frequency	UL # RB	UL RB Offset	Modulation	UL Channel	UL Frequency	UL # RB	UL RB Offset	
Max	LTE B5	10MHz + 10MHz	QPSK	20450	829.0	1	49	QPSK	20549	838.9	1	0	24.66
				20475	831.5	1	49		20574	841.4	1	0	24.54
				20600	844.0	1	0		20501	834.1	1	49	24.51
			QPSK	20450	829	50	0	QPSK	20549	838.9	50	0	22.75
			16-QAM	20450	829	50	0	16-QAM	20549	838.9	50	0	21.76
			64-QAM	20450	829	50	0	64-QAM	20549	838.9	50	0	21.71
			256-QAM	20450	829	50	0	256-QAM	20549	838.9	50	0	19.73

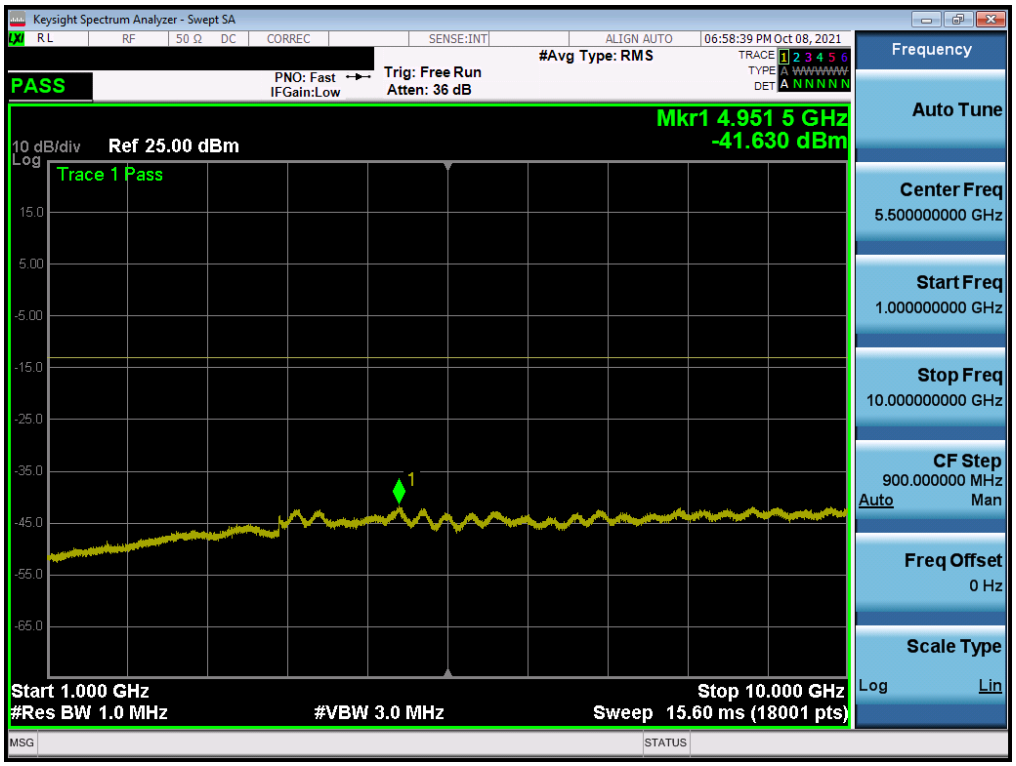
Table 7-6. Conducted Power Output Data (ULCA LTE Band 5)



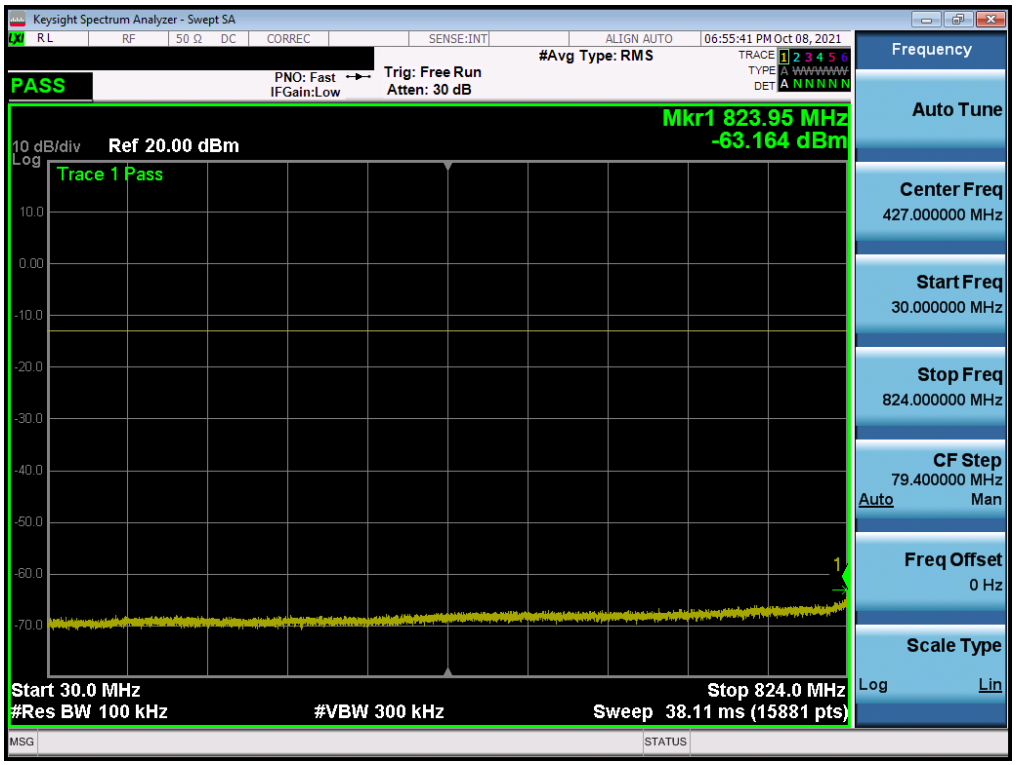
Plot 7-84. Conducted Spurious Plot (ULCA LTE Band 5 – 10+10MHz QPSK – PCC 1/49 SCC 1/0 - Low Channel)



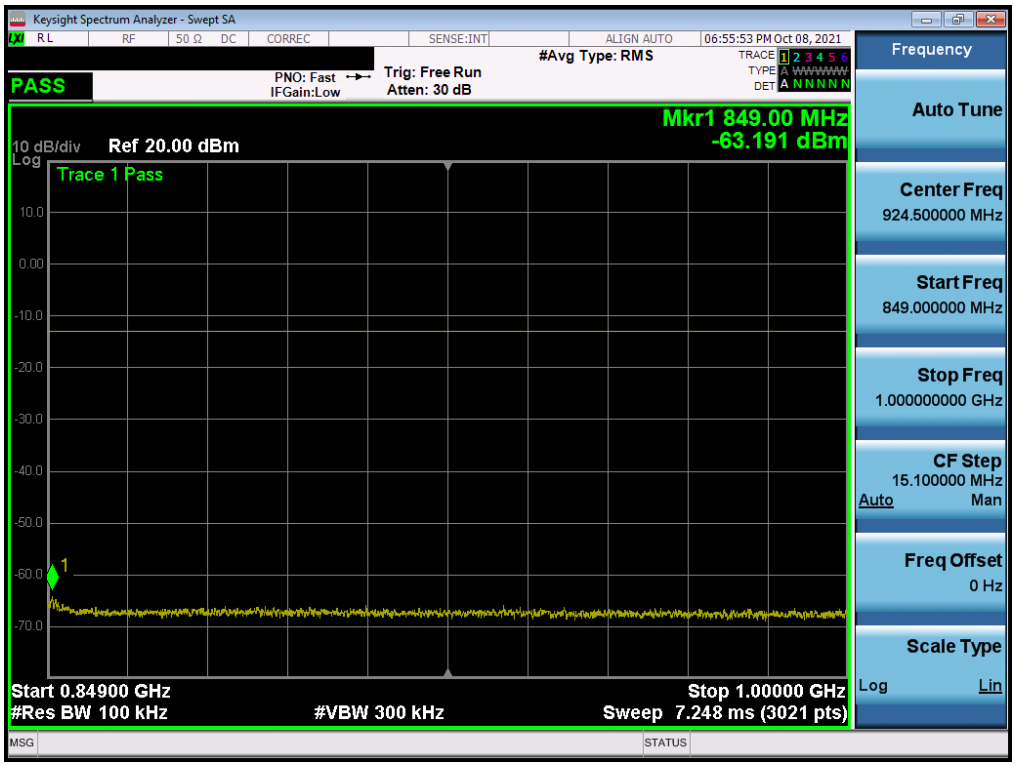
Plot 7-85. Conducted Spurious Plot (ULCA LTE Band 5 – 10+10MHz QPSK – PCC 1/49 SCC 1/0 - Low Channel)



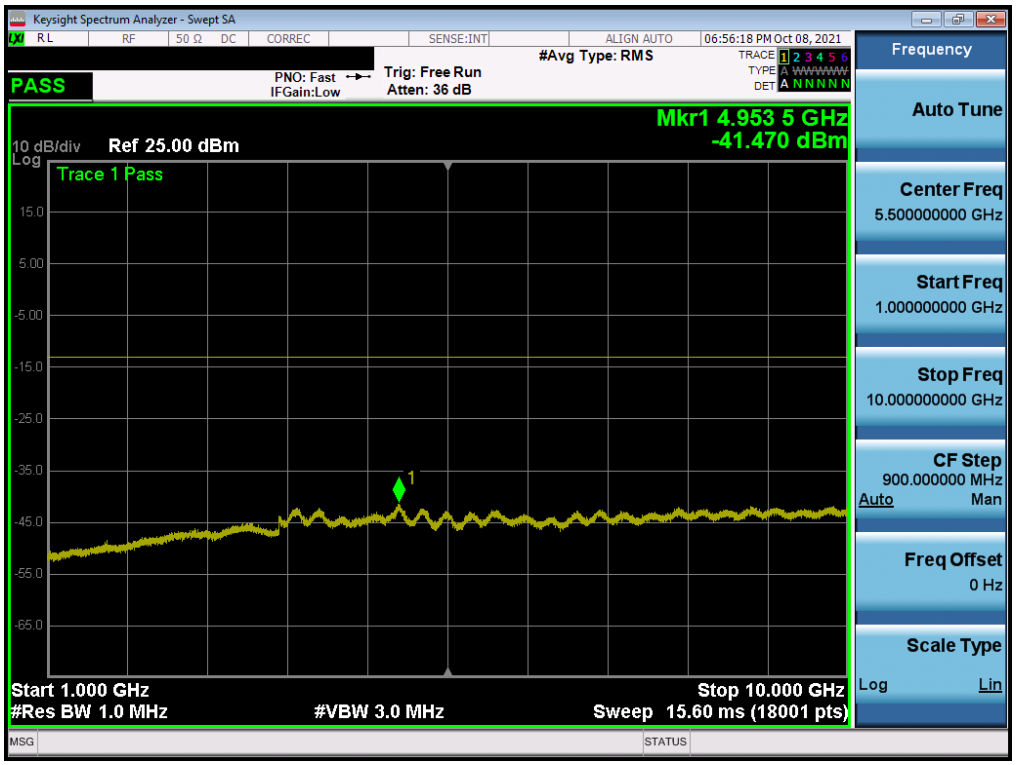
Plot 7-86. Conducted Spurious Plot (ULCA LTE Band 5 – 10+10MHz QPSK – PCC 1/49 SCC 1/0 - Low Channel)



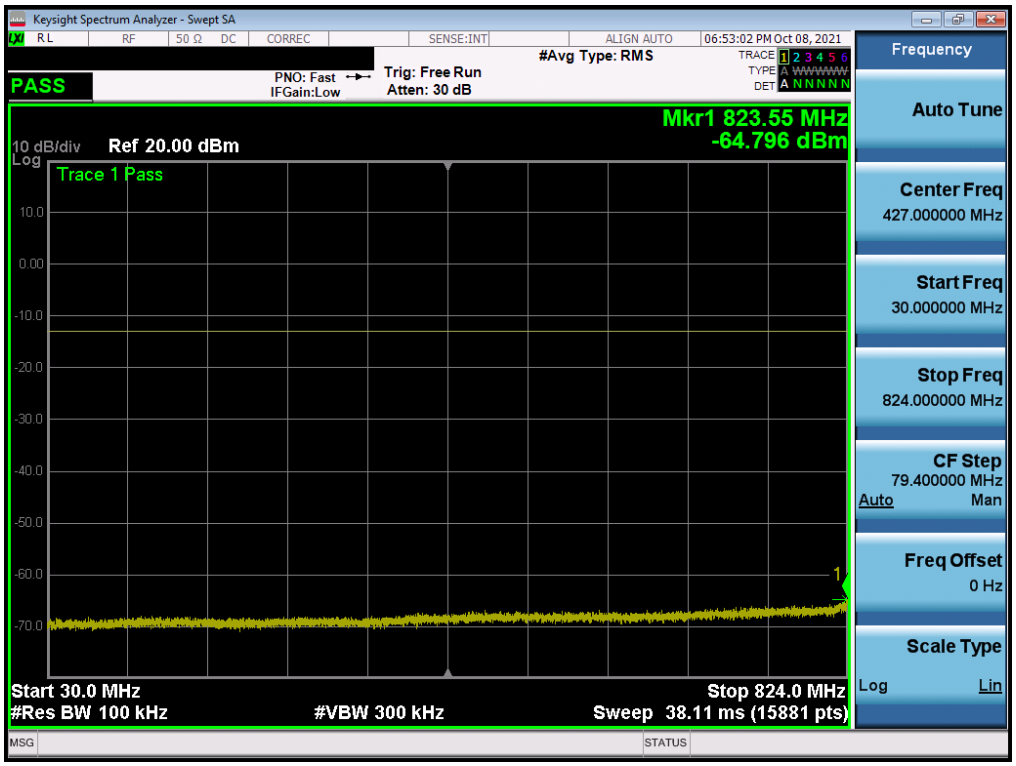
Plot 7-87. Conducted Spurious Plot (ULCA LTE Band 5 – 10+10MHz QPSK – PCC 1/49 SCC 1/0 - Mid Channel)



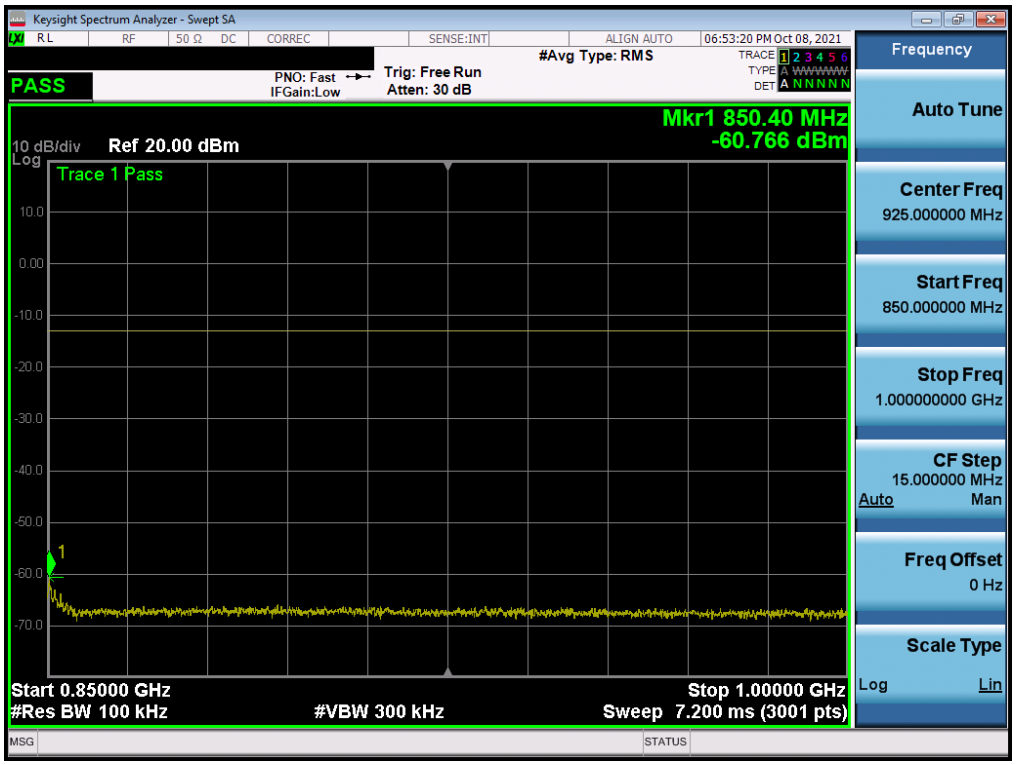
Plot 7-88. Conducted Spurious Plot (ULCA LTE Band 5 – 10+10MHz QPSK – PCC 1/49 SCC 1/0 - Mid Channel)



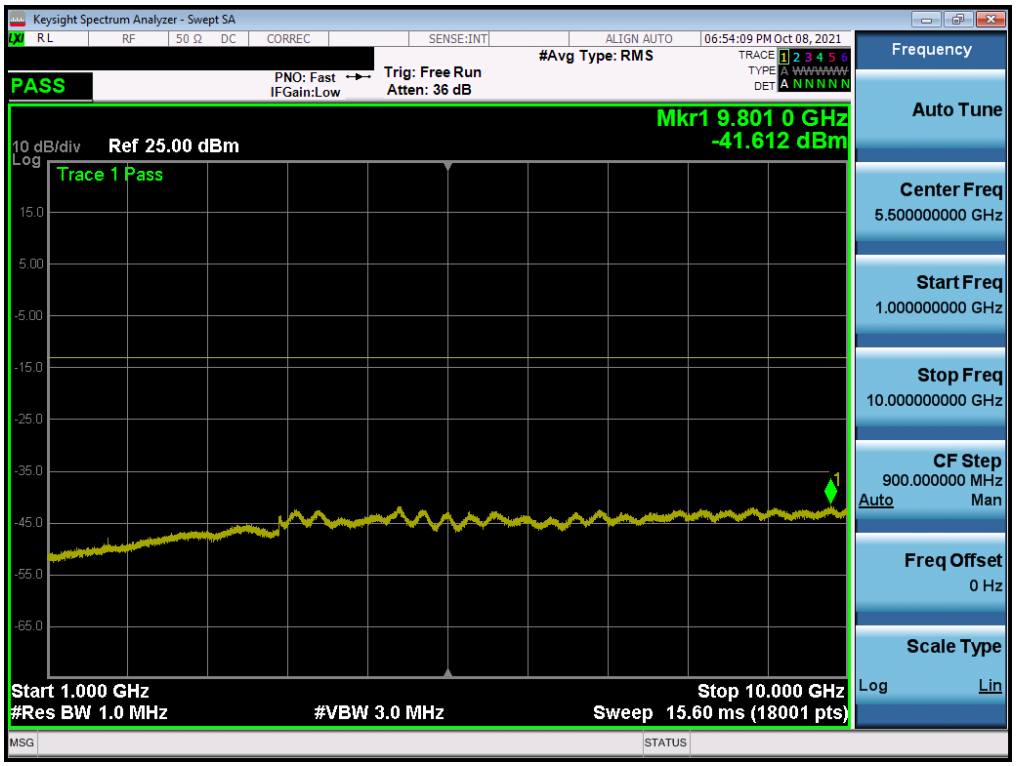
Plot 7-89. Conducted Spurious Plot (ULCA LTE Band 5 – 10+10MHz QPSK – PCC 1/49 SCC 1/0 - Mid Channel)



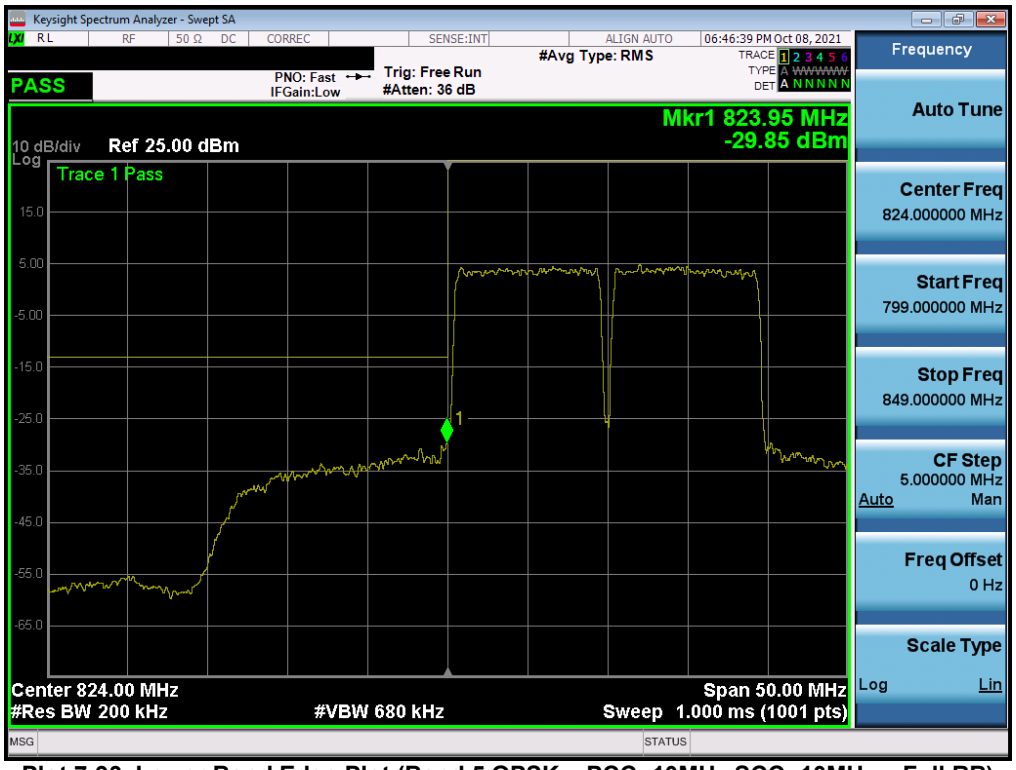
Plot 7-90. Conducted Spurious Plot (ULCA LTE Band 5 – 10+10MHz QPSK – PCC 1/0 SCC 1/49 - High Channel)



Plot 7-91. Conducted Spurious Plot (ULCA LTE Band 5 – 10+10MHz QPSK – PCC 1/0 SCC 1/49 - High Channel)



Plot 7-92. Conducted Spurious Plot (ULCA LTE Band 5 – 10+10MHz QPSK – PCC 1/0 SCC 1/49 - High Channel)



Plot 7-93. Lower Band Edge Plot (Band 5 QPSK – PCC: 10MHz SCC: 10MHz – Full RB)

Plot 7-94. Upper Band Edge Plot (Band 5 QPSK – PCC: 10MHz SCC: 10MHz – Full RB)

Uplink CA Configuration n5 – n77

PCC							SCC							PCC Conducted Power [dBm]	SCC Conducted Power [dBm]	Inter-Band ULCA Total Tx. Power (dBm)
PCC Band	PCC Bandwidth [MHz]	PCC Channel	PCC Frequency (MHz)	PCC (UL) channel	Mod.	PCC UL RB#/Offset	SCC Band	SCC Channel	SCC Frequency (MHz)	SCC Bandwidth [MHz]	SCC (UL) channel	Mod.	SCC UL RB#/Offset			
n5	20	166800	834	Low	π/2 BPSK	1 / 53	n77	650000	3750	100	Low	π/2 BPSK	1 / 136	20.48	20.57	23.54
					QPSK	100 / 0						QPSK	270 / 0	20.32	20.52	23.43
					QPSK	1 / 26						QPSK	1 / 68	20.61	20.24	23.44
					QPSK	1 / 53						QPSK	1 / 136	20.50	20.59	23.56
					QPSK	1 / 79						QPSK	1 / 204	20.45	20.57	23.52
					16Q	1 / 53						16Q	1 / 136	20.67	20.91	23.80
		167300	836.5	Mid	π/2 BPSK	1/26		656000	3840		Mid	π/2 BPSK	1/68	20.54	20.31	23.44
					QPSK	100 / 0						QPSK	270 / 0	20.32	19.98	23.16
					QPSK	1 / 26						QPSK	1 / 68	20.55	20.34	23.46
					QPSK	1 / 53						QPSK	1 / 136	20.41	20.06	23.25
					QPSK	1 / 79						QPSK	1 / 204	20.38	19.63	23.03
					16Q	1/26						16Q	1/68	20.71	20.58	23.66
		167800	839	High	π/2 BPSK	1 / 79		662000	3930		High	π/2 BPSK	1 / 204	20.33	19.93	23.14
					QPSK	100 / 0						QPSK	270 / 0	20.27	19.93	23.11
					QPSK	1 / 26						QPSK	1 / 68	20.41	19.79	23.12
					QPSK	1 / 53						QPSK	1 / 136	20.30	19.92	23.12
					QPSK	1 / 79						QPSK	1 / 204	20.29	20.01	23.16
					16Q	1 / 79						16Q	1 / 204	20.56	20.14	23.37

Table 7-7. Conducted Power Output Data (ULCA NR n5 – n77)

7.7 Radiated Spurious Emissions Measurements

Test Overview

Radiated spurious emissions measurements are performed using the field strength conversion method described in KDB 971168 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using horizontally and vertically polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas. All measurements are performed as RMS measurements while the EUT is operating at maximum power, and at the appropriate frequencies.

Test Procedures Used

KDB 971168 D01 v03r01 – Section 5.8

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW ≥ 3 x RBW
3. Span = 1.5 times the OBW
4. No. of sweep points ≥ 2 x span / RBW
5. Detector = RMS
6. Trace mode = Average (Max Hold for pulsed emissions)
7. The trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

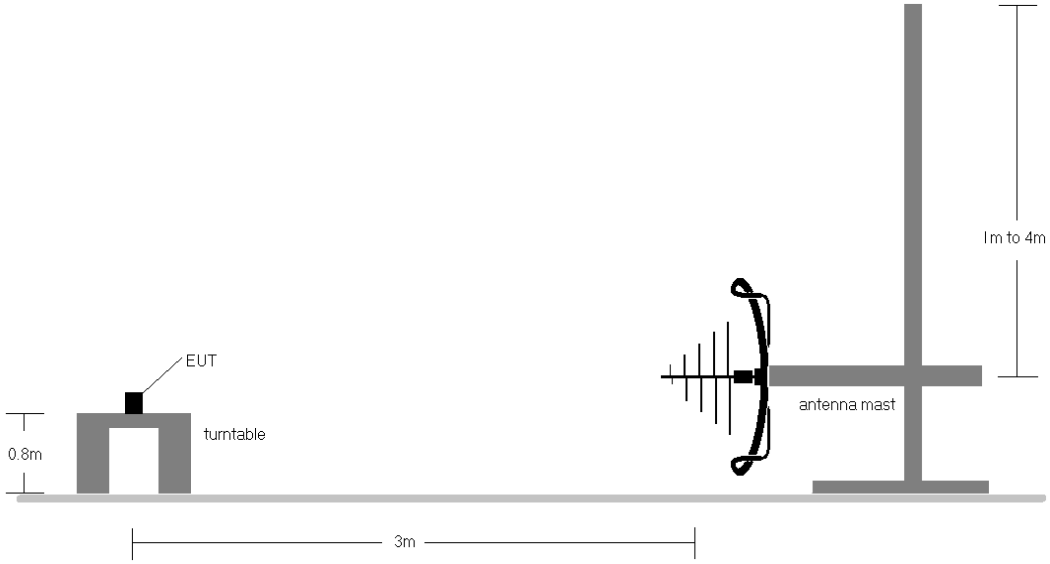


Figure 7-6. Test Instrument & Measurement Setup < 1GHz

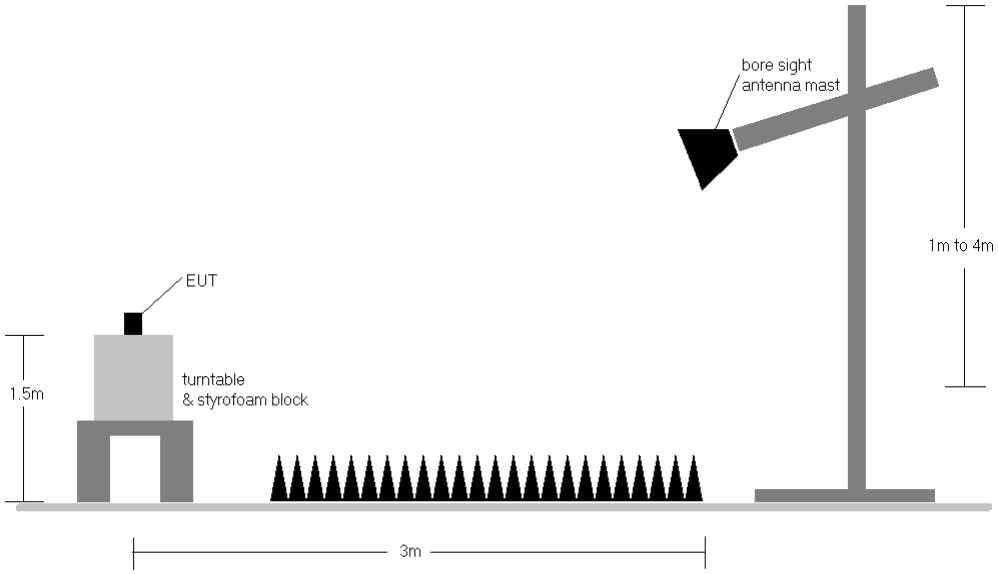


Figure 7-7. Test Instrument & Measurement Setup >1 GHz

Test Notes

1) Field strengths are calculated using the Measurement quantity conversions in KDB 971168 Section 5.8.4.
   a) E(dBµV/m) = Measured amplitude level (dBm) + 107 + Cable Loss (dB) + Antenna Factor (dB/m)
   b) EIRP (dBm) = E(dBµV/m) + 20logD – 104.8; where D is the measurement distance in meters.

2) This device employs GSM, GPRS, and EDGE capabilities. The EUT was tested under all configurations and the highest powers is reported in GPRS mode while transmitting with one slot active.

3) This device employs UMTS technology with WCDMA (AMR/RMC) and HSDPA capabilities. The EUT was tested under all configurations and the highest power is reported in WCDMA mode with HSDPA Inactive at 12.2 kbps RMC and TPC bits all set to "1".

4) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.

5) This unit was tested with its standard battery.

6) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.

7) Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.

8) The "-" shown in the following RSE tables are used to denote a noise floor measurement.

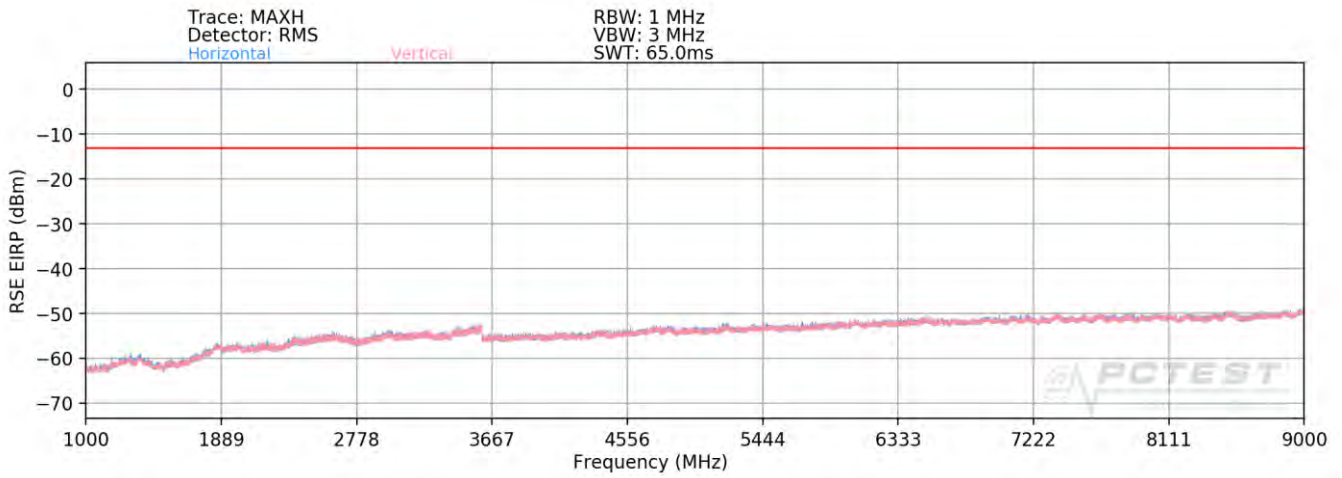
9) ULCA spurious emissions measurements were evaluated for the two contiguous channels using various combinations of RB size, RB offset, modulation, and channel bandwidth. Channel bandwidth data is shown in the tables below based only on the channel bandwidths that were supported in this device.

10) For NR operation, all subcarrier spacings (SCS) and transmission schemes (e.g. CP-OFDM and DFT-s-OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

11) Spurious emissions shown in this section are measured while operating in EN-DC mode with Sub 6GHz NR carrier as well as an LTE carrier (anchor). Spurious emissions from the NR carrier device, is subject to the rules under which the NR carrier operates. Spurious emission caused by the LTE carrier must meet the requirements of the rules under which the LTE carrier operates.

12) Spurious emissions measurements are included in this section to address compliance of the NR FR1 ULCA capability. The EUT was set to transmit at the widest bandwidth and on the middle channel of each band.

LTE Band 26/5



Plot 7-95. Radiated Spurious Plot (LTE Band 26/5)

Bandwidth (MHz):	10
Frequency (MHz):	829
RB / Offset:	1 / 25

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1658.00	H	-	-	-77.08	1.45	31.37	-63.89	-13.00	-50.89
2487.00	H	-	-	-77.85	5.40	34.55	-60.70	-13.00	-47.70
3316.00	H	-	-	-78.53	6.74	35.21	-60.05	-13.00	-47.05
4145.00	H	-	-	-78.96	8.01	36.05	-59.21	-13.00	-46.21

Table 7-8. Radiated Spurious Data (LTE Band 26/5 – Low Channel)

Bandwidth (MHz):	10
Frequency (MHz):	836.5
RB / Offset:	1 / 25

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1673.00	H	-	-	-77.34	1.61	31.27	-63.99	-13.00	-50.99
2509.50	H	-	-	-77.93	5.28	34.35	-60.91	-13.00	-47.91
3346.00	H	-	-	-78.78	7.12	35.34	-59.92	-13.00	-46.92
4182.50	H	-	-	-78.83	7.85	36.02	-59.24	-13.00	-46.24

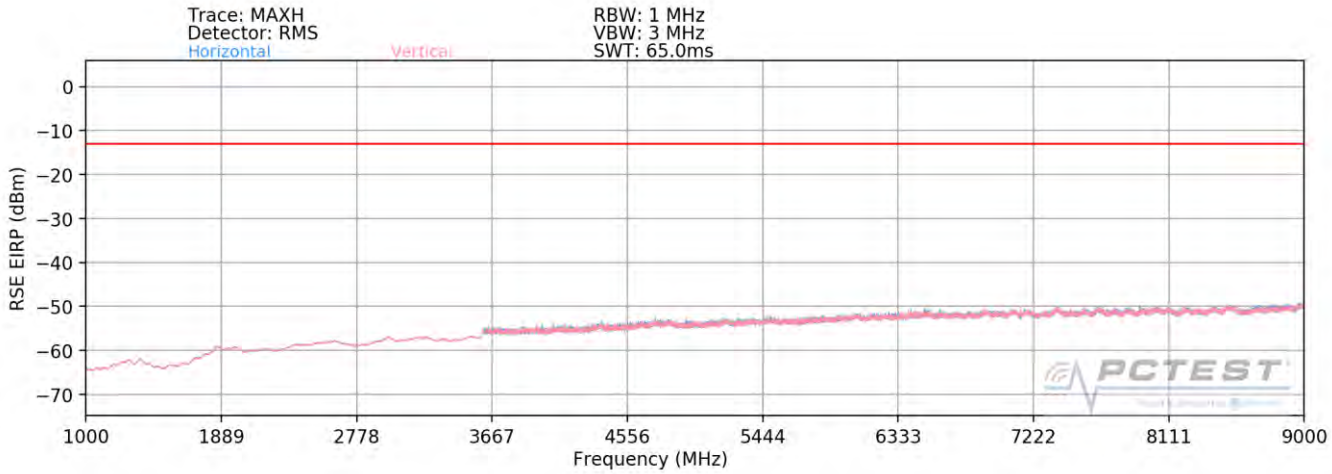
Table 7-9. Radiated Spurious Data (LTE Band 26/5 – Mid Channel)

Bandwidth (MHz):	10
Frequency (MHz):	844
RB / Offset:	1 / 25

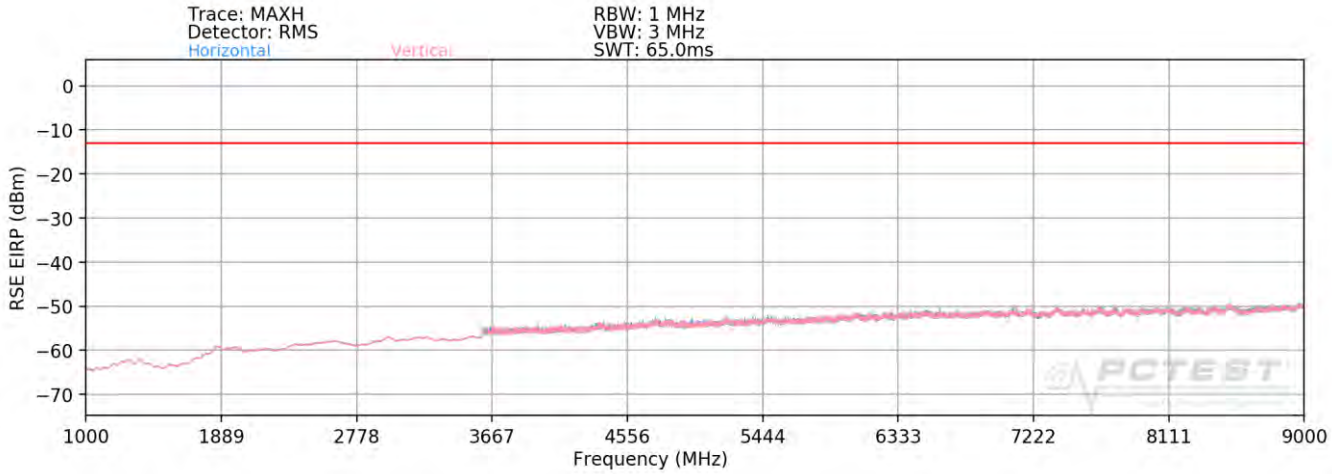
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1688.00	H	-	-	-77.19	1.72	31.53	-63.73	-13.00	-50.73
2532.00	H	-	-	-77.65	5.21	34.56	-60.70	-13.00	-47.70
3376.00	H	-	-	-78.73	7.30	35.57	-59.69	-13.00	-46.69
4220.00	H	-	-	-78.91	7.29	35.38	-59.88	-13.00	-46.88

Table 7-10. Radiated Spurious Data (LTE Band 26/5 – High Channel)

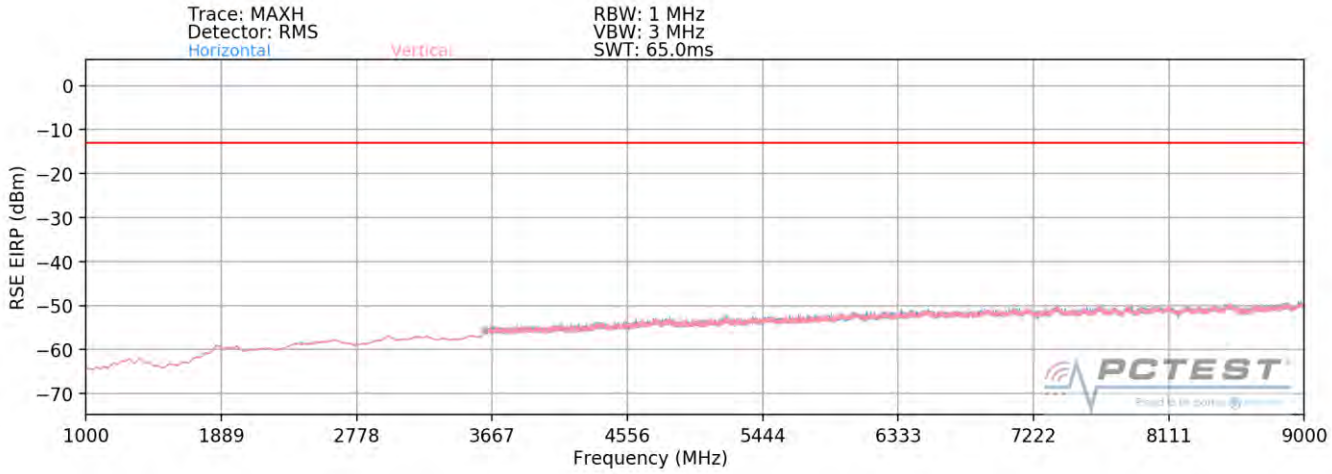
ULCA LTE Band 5



Plot 7-96. Radiated Spurious Plot (ULCA LTE Band 5 – Low Channel)



Plot 7-97. Radiated Spurious Plot (ULCA LTE Band 5 – Mid Channel)



Plot 7-98. Radiated Spurious Plot (ULCA LTE Band 5 – High Channel)

PCC Bandwidth (MHz):	10
PCC Frequency (MHz):	829.0
PCC RB / Offset:	1 / 49
SCC Bandwidth (MHz):	10
SCC Frequency (MHz):	838.9
SCC RB / Offset:	1 / 0

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1658.00	H	-	-	-78.97	-2.28	25.75	-69.51	-13.00	-56.51
2487.00	H	-	-	-79.11	1.95	29.84	-65.42	-13.00	-52.42
3316.00	H	-	-	-77.29	3.07	32.78	-62.48	-13.00	-49.48
4145.00	H	-	-	-77.89	4.21	33.32	-61.94	-13.00	-48.94

Table 7-11. Radiated Spurious Data (ULCA LTE Band 5 – Low Channel)

PCC Bandwidth (MHz):	10
PCC Frequency (MHz):	831.5
PCC RB / Offset:	1 / 49
SCC Bandwidth (MHz):	10
SCC Frequency (MHz):	841.4
SCC RB / Offset:	1 / 0

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1663.00	H	-	-	-78.93	-2.30	25.77	-69.49	-13.00	-56.49
2494.50	H	-	-	-79.14	2.01	29.87	-65.39	-13.00	-52.39
3326.00	H	-	-	-77.38	3.15	32.77	-62.48	-13.00	-49.48
4157.50	H	-	-	-78.28	4.26	32.98	-62.27	-13.00	-49.27

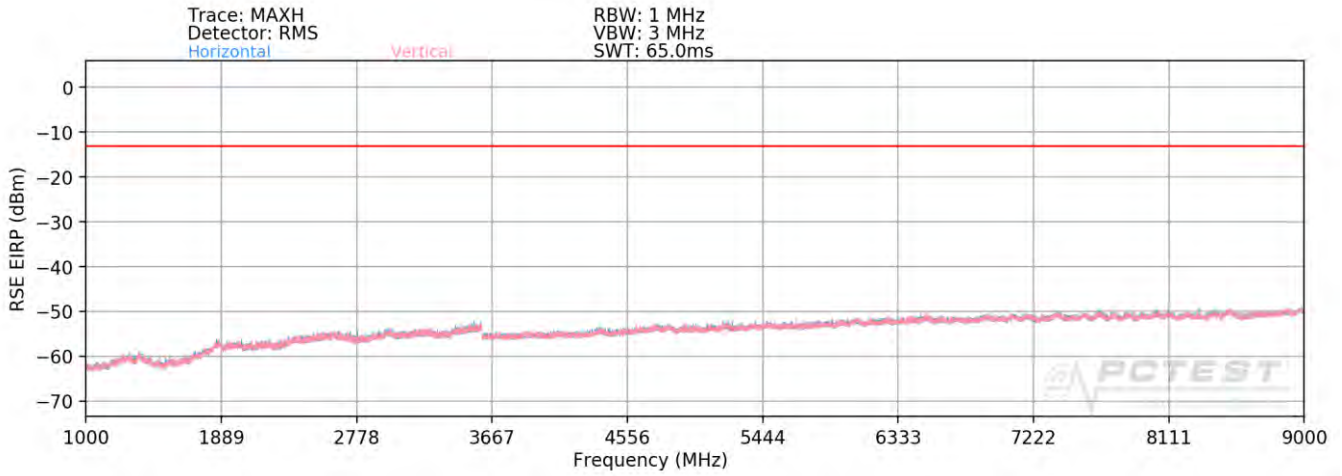
Table 7-12. Radiated Spurious Data (ULCA LTE Band 5 – Mid Channel)

PCC Bandwidth (MHz):	10
PCC Frequency (MHz):	844.0
PCC RB / Offset:	1 / 0
SCC Bandwidth (MHz):	10
SCC Frequency (MHz):	834.1
SCC RB / Offset:	1 / 49

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1688.00	H	-	-	-78.92	-1.80	26.28	-68.98	-13.00	-55.98
2532.00	H	-	-	-79.08	2.54	30.46	-64.79	-13.00	-51.79
3376.00	H	-	-	-77.33	3.09	32.76	-62.50	-13.00	-49.50
4220.00	H	-	-	-78.00	4.07	33.07	-62.19	-13.00	-49.19

Table 7-13. Radiated Spurious Data (ULCA LTE Band 5 – High Channel)

NR Band n5



Plot 7-99. Radiated Spurious Plot (NR Band n5)

Bandwidth (MHz):	20
Frequency (MHz):	834
RB / Offset:	1 / 53
Mode:	Stand Alone

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1668.00	H	-	-	-76.60	-2.27	28.13	-67.12	-13.00	-54.12
2502.00	H	-	-	-76.67	2.15	32.48	-62.78	-13.00	-49.78
3336.00	H	-	-	-77.31	3.27	32.96	-62.30	-13.00	-49.30
4170.00	H	-	-	-77.88	4.36	33.48	-61.78	-13.00	-48.78

Table 7-14. Radiated Spurious Data (NR Band n5 – Low Channel)

Bandwidth (MHz):	20
Frequency (MHz):	836.5
RB / Offset:	1 / 53
Mode:	Stand Alone

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1673.00	H	-	-	-76.74	-2.16	28.10	-67.16	-13.00	-54.16
2509.50	H	-	-	-76.90	2.23	32.33	-62.93	-13.00	-49.93
3346.00	H	-	-	-77.45	3.26	32.81	-62.45	-13.00	-49.45
4182.50	H	-	-	-77.95	4.46	33.51	-61.75	-13.00	-48.75

Table 7-15. Radiated Spurious Data (NR Band n5 – Mid Channel)

Bandwidth (MHz):	20
Frequency (MHz):	839
RB / Offset:	1 / 53
Mode:	Stand Alone

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1678.00	H	-	-	-76.51	-2.04	28.45	-66.81	-13.00	-53.81
2517.00	H	-	-	-76.74	2.41	32.67	-62.59	-13.00	-49.59
3356.00	H	-	-	-77.37	3.22	32.85	-62.41	-13.00	-49.41
4195.00	H	-	-	-77.88	4.31	33.43	-61.82	-13.00	-48.82

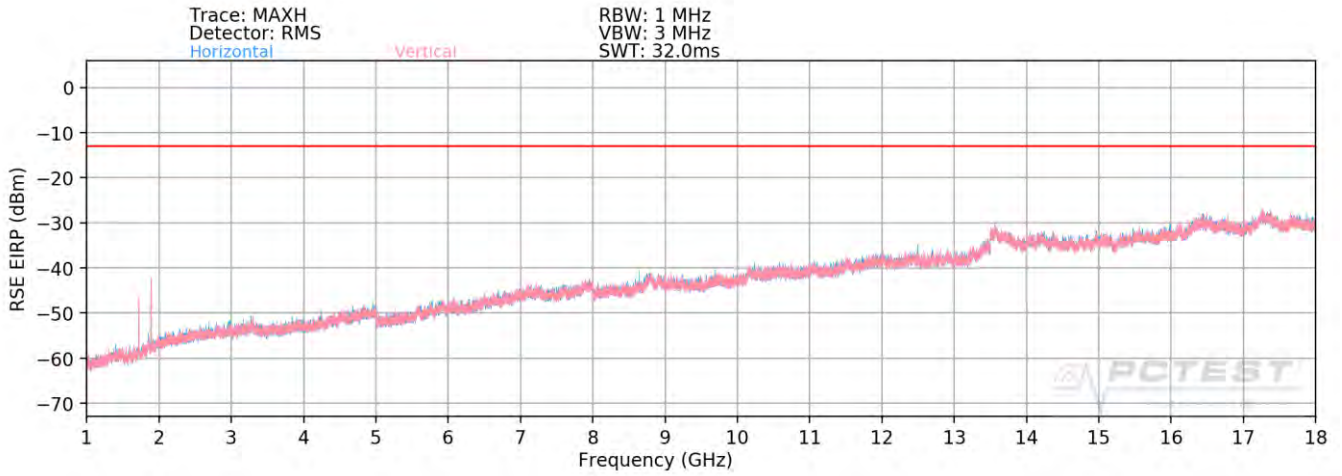
Table 7-16. Radiated Spurious Data (NR Band n5 – High Channel)

Case:	w/ Wireless Charging Pad
Bandwidth (MHz):	20
Frequency (MHz):	836.5
RB / Offset:	1 / 53
Mode:	EN-DC

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1673.00	H	-	-	-76.56	-2.16	28.28	-66.98	-13.00	-53.98
2509.50	H	-	-	-76.88	2.23	32.35	-62.91	-13.00	-49.91
3346.00	H	-	-	-77.46	3.26	32.80	-62.46	-13.00	-49.46
4182.50	H	-	-	-77.93	4.46	33.53	-61.73	-13.00	-48.73

Table 7-17. Radiated Spurious Data with WCP (NR Band n5)

NR Band n5 – B66



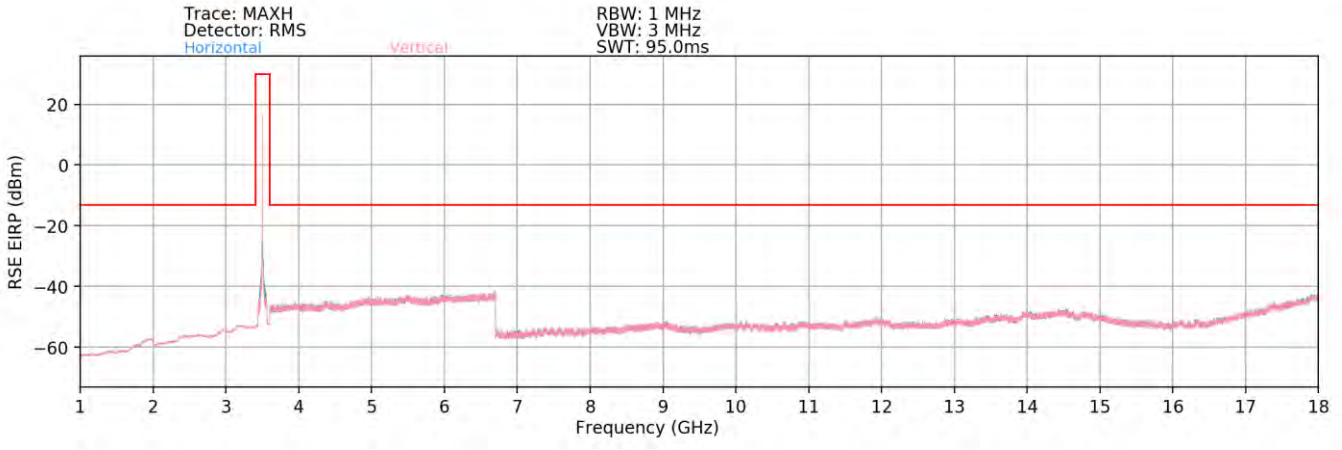
Plot 7-100. Radiated Spurious Plot (NR Band n5 – B66 – 1-18 GHz)

Bandwidth (MHz):	20 / 20
Frequency (MHz):	836.5 / 1745
RB / Offset:	1/50 / 1/53
Mode:	EN-DC
Anchor Band:	LTE Band 66

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1889.00	V	-	-	-79.75	2.76	30.01	-65.25	-13.00	-52.25
2653.50	V	120	58	-78.74	4.81	33.07	-62.19	-13.00	-49.19
2797.50	V	-	-	-79.61	6.22	33.61	-61.64	-13.00	-48.64
3562.00	V	-	-	-80.79	7.30	33.51	-61.74	-13.00	-48.74
4470.50	V	-	-	-81.24	8.30	34.06	-61.20	-13.00	-48.20
5379.00	V	-	-	-81.94	10.84	35.90	-59.36	-13.00	-46.36

Table 7-18. Radiated Spurious Data (NR Band n5 – B66)

NR FR1 ULCA: NR n5 - n77



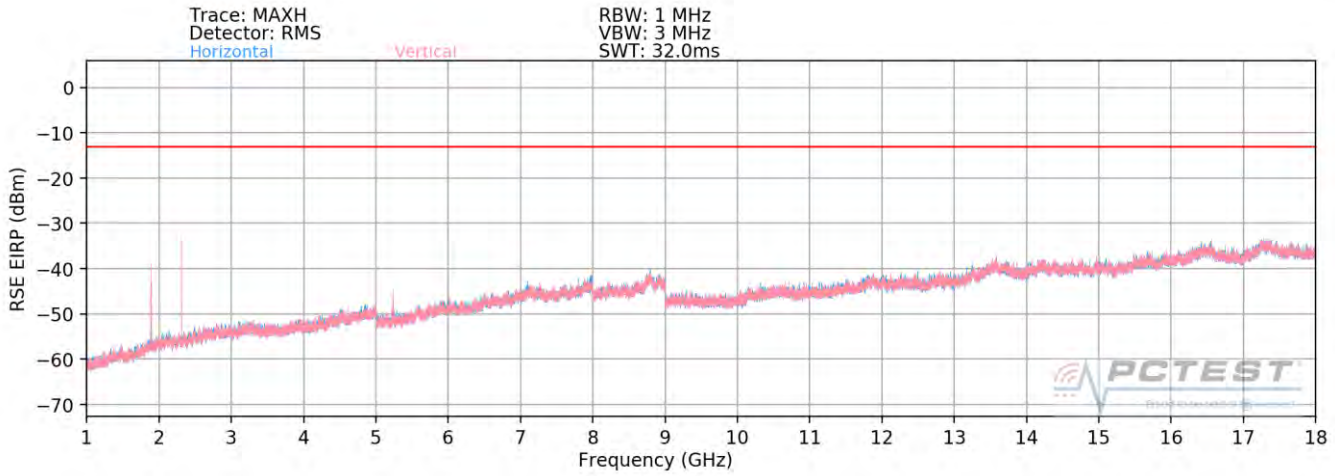
Plot 7-101. Radiated Spurious Plot (NR Band n5 – n77 – 1-18 GHz)

Case:	n5 & n77
Bandwidth (MHz):	20MHz & 100MHz
Frequency (MHz):	836.6MHz & 3840MHz
RB / Offset:	1 / 53 & 1/136
Mode:	FR1 ULCA

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1330.50	H	-	-	-76.70	7.12	37.42	-57.84	-13.00	-44.84
2167.00	H	-	-	-77.12	10.56	40.44	-54.81	-13.00	-41.81
3003.50	H	-	-	-77.40	12.71	42.31	-52.95	-13.00	-39.95
4676.50	H	-	-	-77.72	15.00	44.28	-50.98	-13.00	-37.98

Table 7-19. Radiated Spurious Data (NR Band n5 – n77)

NR Band n5 – B30



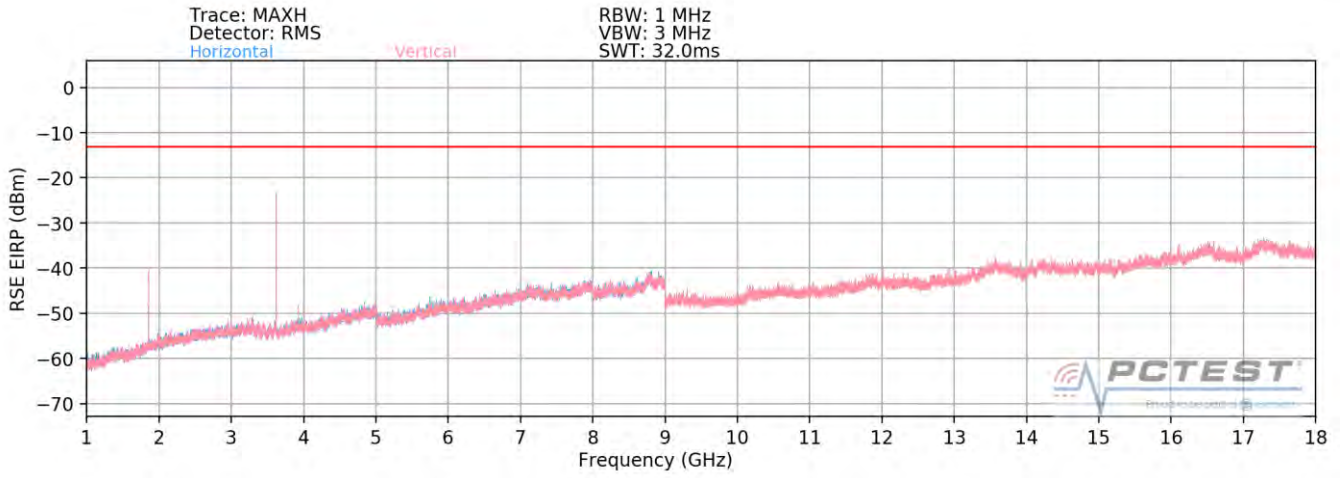
Plot 7-102. Radiated Spurious Plot (NR Band n5 – B30 – 1-18 GHz)

Bandwidth (MHz):	20 / 10
Frequency (MHz):	836.5 / 2310
RB / Offset:	1/50 / 1/25
Mode:	EN-DC
Anchor Band:	LTE Band 30

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
2110.50	V	-	-	-79.40	3.90	31.50	-63.76	-13.00	-50.76
3584.00	V	-	-	-80.74	7.74	34.00	-61.25	-13.00	-48.25
3783.00	V	132	121	-76.14	7.90	38.76	-56.50	-13.00	-43.50
5057.50	V	-	-	-81.32	10.32	36.00	-59.26	-13.00	-46.26
5257.00	V	-	-	-81.70	10.70	36.00	-59.26	-13.00	-46.26
6730.00	V	-	-	-82.11	13.91	38.80	-56.46	-13.00	-43.46
8204.00	V	-	-	-82.52	16.69	41.17	-54.09	-13.00	-41.09

Table 7-20. Radiated Spurious Data (NR Band n5 – B30)

NR Band n5 – B48



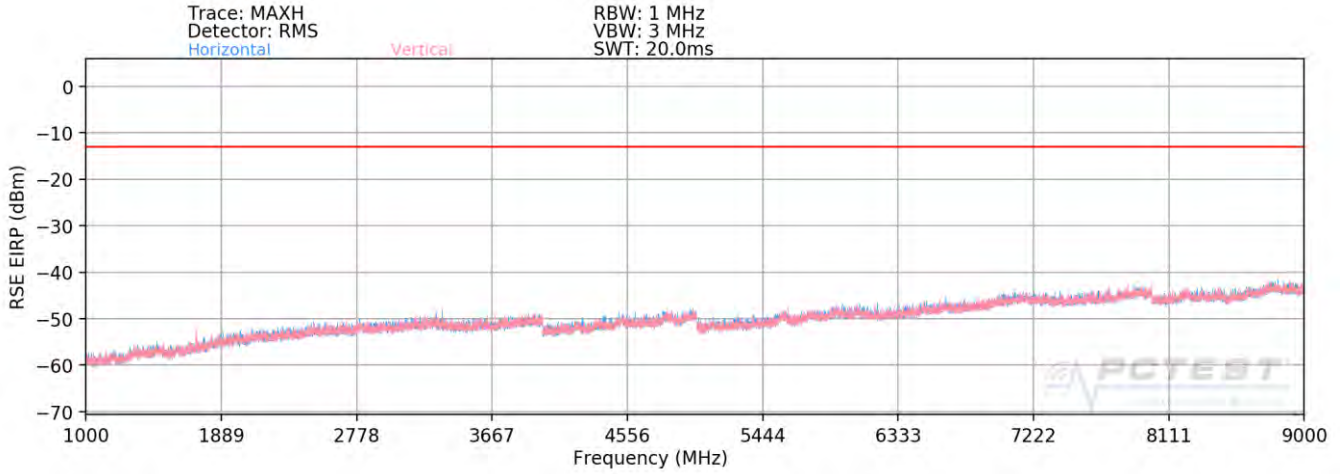
Plot 7-103. Radiated Spurious Plot (NR Band n5 – B48 – 1-18 GHz)

Bandwidth (MHz):	20 / 20
Frequency (MHz):	836.5 / 3625
RB / Offset:	1/53 / 1/50
Mode:	EN-DC
Anchor Band:	LTE Band 48

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1952.00	V	-	-	-78.97	2.93	30.96	-64.30	-13.00	-51.30
4740.00	V	-	-	-81.22	9.44	35.22	-60.04	-13.00	-47.04
6413.00	V	-	-	-82.10	13.13	38.03	-57.23	-13.00	-44.23
7529.00	V	-	-	-82.54	15.99	40.45	-54.81	-13.00	-41.81
9202.00	V	-	-	-83.18	18.36	42.18	-53.08	-13.00	-40.08
10317.00	V	-	-	-83.86	21.67	44.81	-50.45	-13.00	-37.45

Table 7-21. Radiated Spurious Data (NR Band n5 – B48)

GSM/GPRS Cell



Plot 7-104. Radiated Spurious Plot (GPRS Cell)

Mode:	GPRS 1 Tx Slot
Channel:	128
Frequency (MHz):	824.2

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1648.40	V	115	85	-68.26	0.53	39.27	-55.99	-13.00	-42.99
2472.60	V	-	-	-70.12	5.05	41.93	-53.33	-13.00	-40.33
3296.80	V	-	-	-71.50	7.40	42.90	-52.36	-13.00	-39.36
4121.00	V	-	-	-72.39	8.16	42.77	-52.49	-13.00	-39.49
4945.20	V	-	-	-72.30	9.45	44.15	-51.11	-13.00	-38.11
5769.40	V	-	-	-73.13	12.41	46.28	-48.98	-13.00	-35.98
6593.60	V	-	-	-74.06	13.67	46.61	-48.65	-13.00	-35.65
7417.80	V	-	-	-74.21	16.27	49.06	-46.20	-13.00	-33.20

Table 7-22. Radiated Spurious Data (GPRS Cell – Low Channel)

Mode:	GPRS 1 Tx Slot
Channel:	190
Frequency (MHz):	836.6

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1673.20	V	293	39	-68.32	1.14	39.82	-55.44	-13.00	-42.44
2509.80	V	-	-	-70.53	5.37	41.84	-53.42	-13.00	-40.42
3346.40	V	-	-	-71.57	7.16	42.59	-52.67	-13.00	-39.67
4183.00	V	-	-	-72.89	7.85	41.96	-53.30	-13.00	-40.30
5019.60	V	-	-	-72.57	10.03	44.46	-50.80	-13.00	-37.80
5856.20	V	-	-	-74.04	11.97	44.93	-50.33	-13.00	-37.33
6692.80	V	-	-	-73.80	14.36	47.56	-47.70	-13.00	-34.70
7529.40	V	-	-	-74.71	15.99	48.28	-46.98	-13.00	-33.98

Table 7-23. Radiated Spurious Data (GPRS Cell – Mid Channel)

Mode:	GPRS 1 Tx Slot
Channel:	251
Frequency (MHz):	848.8

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1697.60	V	369	139	-69.24	1.57	39.33	-55.92	-13.00	-42.92
2546.40	V	-	-	-71.56	5.05	40.49	-54.77	-13.00	-41.77
3395.20	V	-	-	-72.11	6.74	41.63	-53.63	-13.00	-40.63
4244.00	V	-	-	-72.47	8.61	43.14	-52.11	-13.00	-39.11
5092.80	V	-	-	-72.45	9.81	44.36	-50.90	-13.00	-37.90
5941.60	V	-	-	-73.77	12.81	46.04	-49.22	-13.00	-36.22
6790.40	V	-	-	-74.44	14.90	47.46	-47.80	-13.00	-34.80
7639.20	V	-	-	-75.05	16.46	48.41	-46.85	-13.00	-33.85

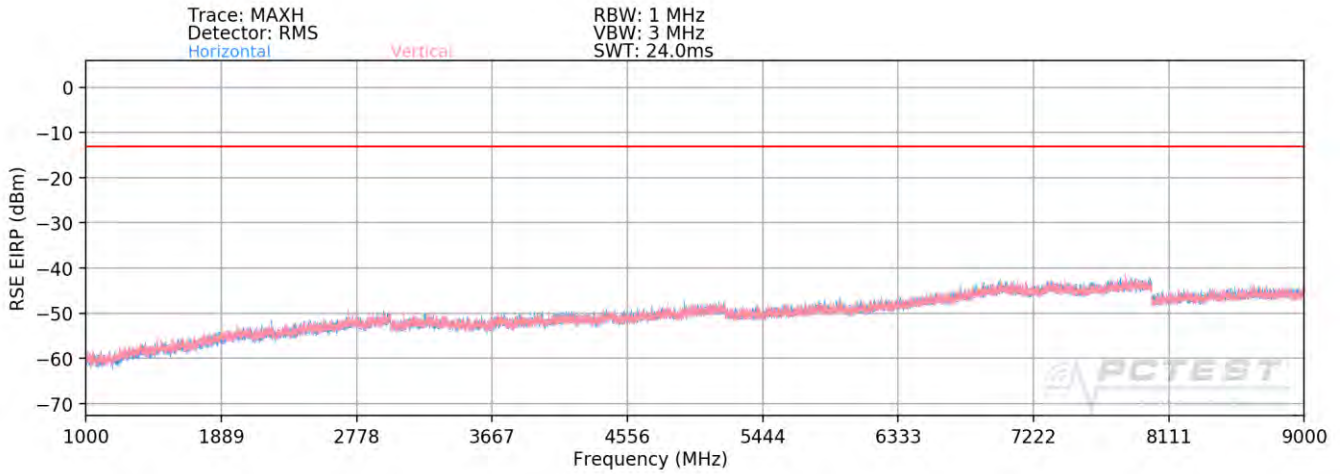
Table 7-24. Radiated Spurious Data (GPRS Cell – High Channel)

Case:	w/ Wireless Charging Pad
Mode:	GPRS 1 Tx Slot
Channel:	190
Frequency (MHz):	836.6

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1673.20	V	-	-	-70.01	1.14	38.13	-57.13	-13.00	-44.13
2509.80	V	-	-	-71.14	5.37	41.23	-54.03	-13.00	-41.03
3346.40	V	-	-	-72.50	7.16	41.66	-53.60	-13.00	-40.60
4183.00	V	-	-	-72.19	7.85	42.66	-52.60	-13.00	-39.60
5019.60	V	-	-	-71.99	10.03	45.04	-50.22	-13.00	-37.22
5856.20	V	-	-	-73.43	11.97	45.54	-49.72	-13.00	-36.72
6692.80	V	-	-	-73.32	14.36	48.04	-47.22	-13.00	-34.22
7529.40	V	-	-	-74.80	15.99	48.19	-47.07	-13.00	-34.07

Table 7-25. Radiated Spurious Data with WCP (GPRS Cell)

WCDMA Cell



Plot 7-105. Radiated Spurious Plot (WCDMA Cell)

Mode:	WCDMA RMC
Channel:	4132
Frequency (MHz):	826.4

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1652.80	V	-	-	-77.92	1.36	30.44	-64.81	-13.00	-51.81
2479.20	V	-	-	-78.11	5.32	34.21	-61.05	-13.00	-48.05
3305.60	V	-	-	-78.22	6.65	35.43	-59.83	-13.00	-46.83
4132.00	V	-	-	-78.64	7.85	36.21	-59.04	-13.00	-46.04

Table 7-26. Radiated Spurious Data (WCDMA Cell – Low Channel)

Mode:	WCDMA RMC
Channel:	4183
Frequency (MHz):	836.6

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1673.20	V	-	-	-78.95	1.61	29.66	-65.60	-13.00	-52.60
2509.80	V	-	-	-78.37	5.27	33.90	-61.36	-13.00	-48.36
3346.40	V	-	-	-78.79	7.13	35.34	-59.92	-13.00	-46.92
4183.00	V	-	-	-78.82	7.84	36.02	-59.24	-13.00	-46.24

Table 7-27. Radiated Spurious Data (WCDMA Cell – Mid Channel)

Mode:	WCDMA RMC
Channel:	4233
Frequency (MHz):	846.6

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	EIRP Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1693.20	V	-	-	-79.75	1.78	29.03	-66.23	-13.00	-53.23
2539.80	V	-	-	-77.82	5.13	34.31	-60.95	-13.00	-47.95
3386.40	V	-	-	-79.50	6.95	34.45	-60.81	-13.00	-47.81
4233.00	V	-	-	-78.87	7.54	35.67	-59.58	-13.00	-46.58

Table 7-28. Radiated Spurious Data (WCDMA Cell – High Channel)

7.8 Frequency Stability / Temperature Variation

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-E-2016. The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

For Part 22 and RSS-132, the frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5 ppm) of the center frequency.

Test Procedure Used

ANSI/TIA-603-E-2016

Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Test Setup

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

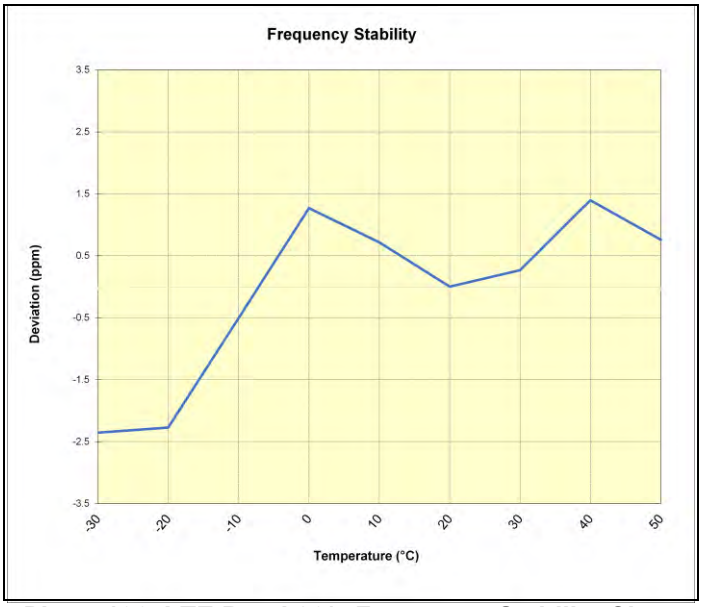
Test Notes

None

LTE Band 26/5	
Operating Frequency (Hz):	836,500,000
Ref. Voltage (VDC):	4.38
Deviation Limit:	± 0.00025% or 2.5 ppm

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.38	- 30	836,499,415	-1,970	-0.0002355
		- 20	836,499,483	-1,902	-0.0002274
		- 10	836,500,963	-422	-0.0000504
		0	836,502,447	1,062	0.0001270
		+ 10	836,501,985	600	0.0000717
		+ 20 (Ref)	836,501,385	0	0.0000000
		+ 30	836,501,608	223	0.0000267
		+ 40	836,502,551	1,166	0.0001394
		+ 50	836,502,018	633	0.0000757
Battery Endpoint	3.48	+ 20	836,501,229	-156	-0.0000186

Table 7-29. LTE Band 26/5 Frequency Stability Data

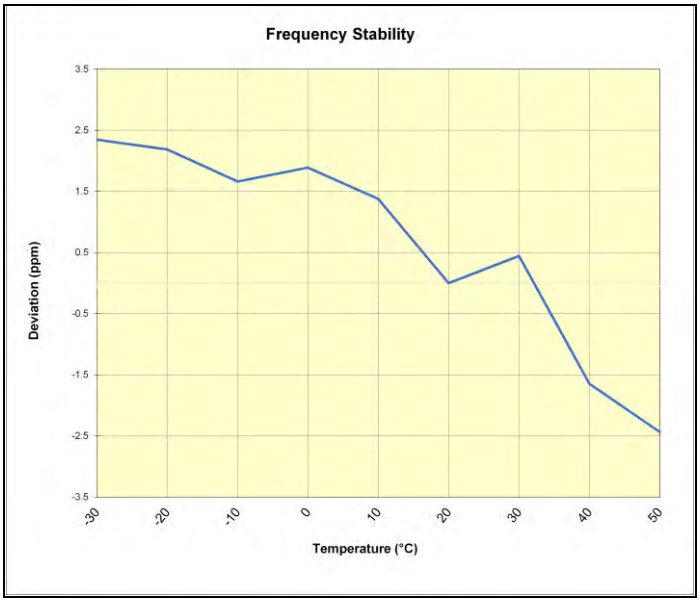


Plot 7-106. LTE Band 26/5 Frequency Stability Chart

NR Band n5	
Operating Frequency (Hz):	836,500,000
Ref. Voltage (VDC):	4.38
Deviation Limit:	± 0.00025% or 2.5 ppm

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.38	- 30	836,582,795	1,962	0.0002345
		- 20	836,582,661	1,828	0.0002185
		- 10	836,582,223	1,390	0.0001662
		0	836,582,414	1,581	0.0001890
		+ 10	836,581,984	1,151	0.0001376
		+ 20 (Ref)	836,580,833	0	0.0000000
		+ 30	836,581,205	372	0.0000445
		+ 40	836,579,456	-1,377	-0.0001646
		+ 50	836,578,796	-2,037	-0.0002435
Battery Endpoint	3.48	+ 20	836,580,715	-118	-0.0000141

Table 7-30. NR Band n5 Frequency Stability Data



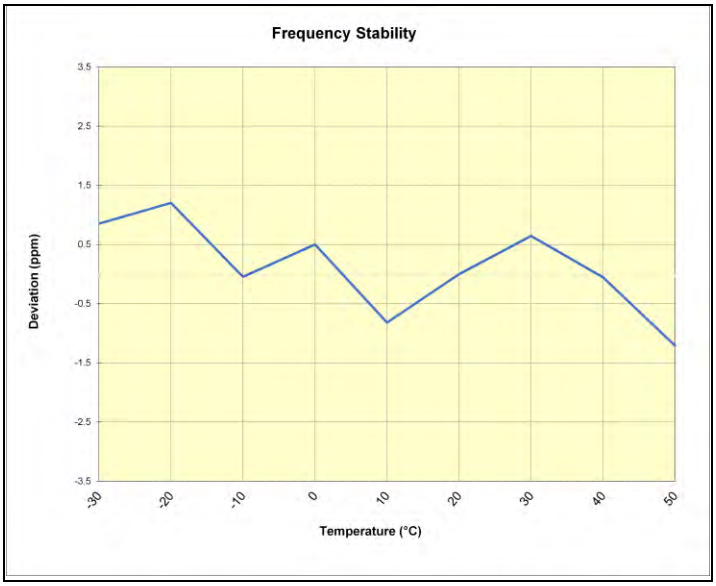
Plot 7-107. NR Band n5 Frequency Stability Chart

GSM/GPRS Cellular

Operating Frequency (Hz):	836,600,000
Ref. Voltage (VDC):	4.38
Deviation Limit:	± 0.00025% or 2.5 ppm

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.38	- 30	836,605,175	714	0.0000853
		- 20	836,605,468	1,007	0.0001204
		- 10	836,604,424	-37	-0.0000044
		0	836,604,880	419	0.0000501
		+ 10	836,603,777	-684	-0.0000817
		+ 20 (Ref)	836,604,461	0	0.0000000
		+ 30	836,605,001	540	0.0000646
		+ 40	836,604,416	-45	-0.0000054
		+ 50	836,603,450	-1,011	-0.0001208
Battery Endpoint	3.19	+ 20	836,604,685	224	0.0000267

Table 7-31. GSM/GPRS Cell Frequency Stability Data



Plot 7-108. GSM/GPRS Cell Frequency Stability Chart

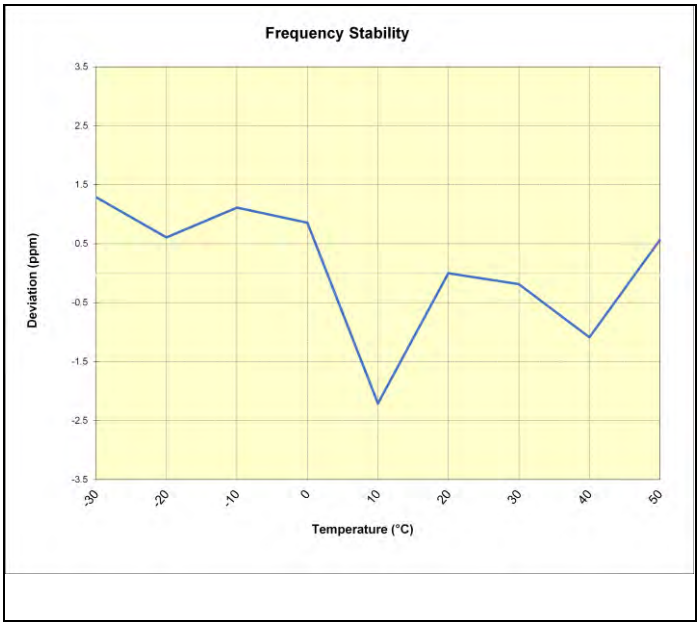
WCDMA Cell

WCDMA Cellular

Operating Frequency (Hz):	836,600,000
Ref. Voltage (VDC):	4.38
Deviation Limit:	± 0.00025% or 2.5 ppm

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.38	- 30	836,620,264	1,081	0.0001292
		- 20	836,619,691	508	0.0000607
		- 10	836,620,114	931	0.0001113
		0	836,619,900	717	0.0000857
		+ 10	836,617,334	-1,849	-0.0002210
		+ 20 (Ref)	836,619,183	0	0.0000000
		+ 30	836,619,028	-155	-0.0000185
		+ 40	836,618,274	-909	-0.0001087
		+ 50	836,619,654	471	0.0000563
Battery Endpoint	3.19	+ 20	836,619,960	777	0.0000929

Table 7-32. WCDMA Cell Frequency Stability Data



Plot 7-109. WCDMA Cell Frequency Stability Chart

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the Samsung **Portable Handset FCC ID: A3LSMS908U** complies with all the requirements of Part 22 of the FCC rules.